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Profits in Fabricating Copper

A Report of a Talk at a Meeting of the New York Branch, American Institute of Mining and Metallurgical Engineers

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At a meeting of the New York Branch of the American Institute of Mining and Metallurgical Engineers, held at the Machinery Club, New York, January 19th, 1926, Arthur Notman, a consulting mining engineer of New York, delivered a lecture covering his investigations into the earnings and profits of the copper and brass fabricating companies of the United States.

The following is a brief abstract of Mr. Notman's speech.

The manufacturing capacity of the copper and copper base alloy fabricators in the United States is approximately 1,500,000,000 pounds per year. The capital stock issued on these compaines has a par value of $140,000,000 and a market value of about twice that figure. In other words, the capital stock amounts to about 9c. per pound of metal fabricated and probably has a priced market value of about 18 cents per pound.

The copper producers, that is miners, smelters and refiners, have securities issued to a total of about 50 cents per pound of copper produced and have a market value of a very little over that figure. This shows that a much heavier investment is necessary to produce a pound of copper than to fabricate it.

Mr. Notman took up the subject of the purchase of the American Brass Company by the Anaconda Copper Mining Company, and divided his discussion into three divisions.

1. The reasons for the purchase of the American Brass Company.
2. Was this purchase justified?
3. If so, should the rest of the copper producing industry adopt similar measures?

AMERICAN BRASS COMPANY

The financial history of the American Brass Company before the sale, that is from 1912 to 1921, was given as follows:

Dividends paid during that period	$23,475,000
Increase in net current assets about	4,200,000
Total for ten years about	27,675,000
Average annual profits	2,767,500

or 18.47 on outstanding capital.

Capitalizing this figure at 7 per cent, a value is reached of about $39,535,000 or 264 per cent of outstanding capital.

The price per share paid for the American Brass Company was $150 in cash and three shares of common stock of the Anaconda company, making a total of $22,500,000 in cash and $22,500,000 in stock at par value.

Unfortunately no production figures for the Brass Company prior to its sale in February, 1922 are available, but the production of the American Brass Company in 1924 was about 520,000,000 pounds of copper and alloys. In a very rough fashion this can be divided into copper, 350,000,000 pounds; zinc, 160,000,000, and miscellaneous metals, the balance.

Independent brass and copper manufacturers were discussed, including the following concerns: American Copper Products Company; Bridgeport Brass Company; Ohio Brass Company; Rome Wire Company; Scovill Manufacturing Company; Standard Underground Cable Company. Analyses of their earnings were given as follows:

AMERICAN COPPER PRODUCTS COMPANY

From December 31, 1921, to January 1, 1925, this company has paid $526,000 in preferred dividends, retired $2,000,000 in preferred stock, and reduced deferred payments by about $350,000. Total profits for these four years were, therefore, about $2,876,000. There was a decrease in net current assets during this period of about $1,475,000, leaving a total of net profits of about $1,400,000 during these four years. No common dividends were paid but the annual earnings are about 10 per cent on the $3,500,000 investment. Capitalized at 7 per cent, these earnings show a value of about $5,000,000.

BRIDGEPORT BRASS COMPANY

The Bridgeport Brass Company on a capital stock of $2,000,000 showed an annual income during the four year-period mentioned above, of $106,000. Capitalized at 7 per cent, this would show a value of $1,514,000 or about 75 per cent of the capital stock outstanding.

OHIO BRASS COMPANY

The Ohio Brass Company in these four years has paid out cash dividends of $3,000,000. Increase of net current assets has been about $2,800,000. Calculated in the same way as the above, figuring the annual income and capitalizing this income at 7 per cent, this company shows a worth of $18,700,000 or 46 per cent of the stock outstanding.

ROME WIRE COMPANY

Dividends	$1,116,000
Increase in net current assets	4,165,000
Total profits	5,281,000

Deducting borrowings and other indebtedness incurred during this period, leaves a net income of $2,800,000 for this period or about $700,000 annually. Capitalized at 7 per cent, this shows a worth of $10,000,000 or 154 per cent of the capital stock outstanding.

SCOVILL MANUFACTURING COMPANY

Dividends	$7,250,000
Increase in net current assets	3,850,000
Total profits	11,100,000

Calculating similarly to the above, and capitalizing the annual income at 7 per cent, the Scovill company shows a value of 221 per cent of the par value of its outstanding stock.

STANDARD UNDERGROUND CABLE COMPANY

This company shows a worth of 179 per cent of the outstanding capital stock.

PRODUCERS' PROFITS

The domestic production of electrolytic copper for the four years 1921 to 1924 inclusive, by a group of the more important mines was about 4,280,000,000 lbs. The bond interest and dividends paid by these properties over this period amounted to about $120,000,000. There was little, if any, increase in net current assets for this group as a whole so that the income for the period, as measured in the case of the manufacturing companies, was about 2½ cents per pound. The investment of these companies might be calculated at varying figures from 35 to 50 cents per pound of annual output depending on whether one chooses maximum capacity or average annual output for the period. Taking the lower figure of 35 cents, the above income represents a yield of only 7 per cent, which must provide for the return of the capital invested with interest during the life of the deposits before there is any real profit. Some of these properties might be regarded as having indefinite reserves of ore; others may at some later stage of their development be entitled to similar classification. It is well to remember that as yet no important copper district in the world has been exhausted. However, a fair estimate of the reserves for the group would be 25 to 30 years at the present rate of output.

A 7 per cent annual dividend will return the capital investment with 5 per cent interest in 28 years. In other words, the real income on such an investment would be little more than the going rate on high-class bonds. It is this figure which must be compared with the 15 per cent yield of the manufacturing companies over this same period on their outstanding capital stock, a lot of which was the result of stock dividends. It should be remembered that copper, wire and brass manufacturing must be regarded as a self-perpetuating industry and not one of wasting assets.

It seems safe to assume that the Anaconda Copper Mining Company paid at least the full amount of the investment of the American Brass Company at the time of its purchase in 1922. This, as we have seen, was about 12 cents per pound on annual copper output. Applying this figure to the above group of manufacturing companies, we find an investment of $60,000,000 yielding an income of $6,000,000. This is equivalent to 10 per cent or double the yield secured by the producers of electrolytic copper. This should answer any criticism that Mr. Notman compared capital issues of the manufacturing division with book values of the raw material division. In the former case the stock dividends have very likely capitalized this additional earning power without increasing the real investment.

Mr. Notman stressed the point that the profits in the manufacture of copper were much higher than the profits in producing copper. For example, he cited that the differential between electrolytic and finished product in producing a pound of wire was about 2¼ cents. Profits of wire companies, based on assumed output for the period considered (actually figures not available) indicate a profit 1 cent per pound or 40 per cent of the total spread, while the normal margin of the raw material units is only 25 per cent of their spread from copper in the ground to electrolytic on the market.

Mr. Notman discussed the differential between raw copper and the manufactured products and gave the following statistics, pointing out that they showed that manufacturers were able to maintain their differential and realize profits even in bad times whereas producers were at the mercy of outside markets, made more difficult by the great increase of competition among copper producing companies.

COPPER SHEETS

Engineering and Mining and Journal Press. Quotations on Electrolytic and Sheets

Year	Differential, per lb.
1912 January 13	5¾ cents
1913 January 18	7½ cents
1914 January 17	7¼ cents
1915 January 16	5¾ cents
1916 January 15	7⅜ cents
1917 January 13	16 cents
1918 January 26	8 cents
1919 January 11	14 cents
1920 January 24	10⅝ cents
1921 January 8	8½ cents
1922 January 7	7¾ cents
1923 January 20	7⅝ cents
1924 January 16	8¼ cents
1925 January 24	8⅛ cents
Present January 26	8⅜ cents

These figures show that the average differential for the last seven years has been 1½ to 3 cents higher than the pre-war average.

COPPER PRODUCTS

Current Differentials in Daily Metal Reporter, January 12, 1926.

Wire	2¼ cents
Sheet	8⅜ cents
Bottoms	18⅜ cents
Rolls	7¼ cents
Brush	10½ cents
Untrimmed Anodes	6½ cents
Oval Anodes	5 cents

BRASS

Sheet-High Brass	6⅝ cents
Sheet-Low Brass	7⅛ cents
Sheet-Rich Low	8⅛ cents
Sheet-Commercial Bronze	9¼ cents
Wire-High Brass	7⅛ cents
Wire-Low Brass	8 cents

CONCLUSION

Mr. Notman stated his conclusions as follows:

The manufacturing and fabricating industries in copper and copper base alloys are in a very strong position. They are not over expanded and the competition among them is not so keen as to make it necessary for them to cut their prices and eliminate profits.

It was a very wise move on the part of the Anaconda company to purchase the American Brass Company for two reasons.

It afforded the Anaconda company an outlet for its metal and it gave them a very profitable business. Mr. Notman recommended that other producers follow in the footsteps of the Anaconda company and obtain control of the fabricating field for several reasons. In the first place such control would prevent over-expansion among the fabricators and a consequent decrease in profits. The prices paid for such companies should be not much over 10 cents of capital investment per pound of metal fabricated. Such an investment would net the purchaser dividend of from 8 per cent to 20 per cent even when the price of copper was low because, as Mr. Notman stated, the brass mills were always able to maintain the differential between the price of raw material and the fabricated product, and the price of raw copper made little difference to them.

Mr. Notman stated that profits in the copper producing industry were now nearly up to the pre-war level in cents per pound, but that, of course, the purchasing power of this profit was very much less. He pointed out that the greatest danger of the industry was over production; that although stocks of refined copper at the present time were comparatively small, reserves of copper ore were greater than at any period in the history of the industry. Former wastes, unworkable deposits, dumps, etc., were now valuable due to new processes and developments in the production of electrolytic copper. He pointed out that the energies of the copper producers had been concentrated upon cutting costs, rightly enough, with the result that they were now able to sell copper at a profit in a 14 cents market whereas they had once stated flatly that copper could not be produced under 18 cents. However, in concentrating upon improved mining, milling, smelting and refining methods, the producers had lost sight of the commercial aspects of their business. He recommended strongly that they acquire this view. He advised the purchase of existing plants at a reasonable figure to care for the output of the individual producers. This would prevent the establishment of new units which would simply enter into competition with old ones, and overexpand the industry, when they could purchase a complete line of customers and an already established business at a fair price. If the existing fabricating units failed to enter such a combination, they might find themselves without a source of supply, if the industry, as a whole, were integrated through the construction of new fabricating units, and the purchase of other existing units, by the raw material producers.

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*From a list of Alloys by Wm. Campbell, published serially in our issues of March, April, May, July, September, December, 1923; June, July, August, September, 1924; May, June, November and December, 1925.

Bellows Diaphragm Metal

Q.—Please send me information concerning the brass used in making flexible bellows diaphrams. Can you tell me the composition of the metal and what its elastic limit would be?

A.—The brass used in the manufacture of springs and diaphrams for pressure regulators is phosphor bronze. The minimum tensile strength must be 40,000 pounds per sq. inch; the yield point 20,000 lbs. per sq. inch and the elongation in 2 inches, 20 per cent.

One of the principal uses of phosphor bronze is for springs. A good mixture for this purpose is as follows: Copper 95 per cent by weight; tin 4.5 per cent; .5 per cent phosphor, tin 0.5 per cent.

The bellows are a seamless corrugated diaphragm drawn from and worked from a flat sheet of metal so as to develop almost incredible ability to withstand continuous flexure and pressure. Extensive use as well as innumerable tests have been made and fully demonstrated its ability to withstand millions of movements without showing the slightest signs of deterioration.

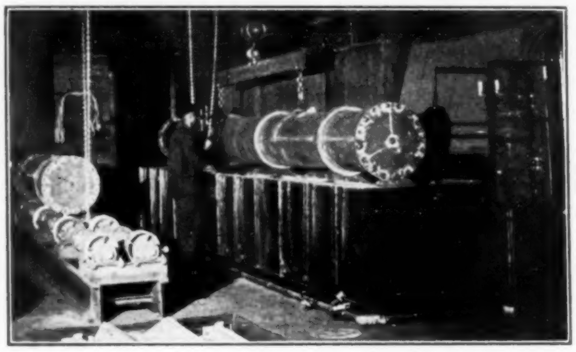
It can be used with assurance that it is as permanent as any other part of the structure.—P. W. Blair.

When Is Electric Heating Advisable?

General Data on Industrial Electric Heating, as Applied to Metals and Metal Products, Abstracted from a Serial Report of the Power Committee (1924-1925), Commercial National Section, National Electric Light Association, New York

Electric service companies, like manufacturers, are not so much interested in the theory or mechanics of new devices or processes as they are in the economics and commercial possibilities involved. It is natural and right that established systems should change slowly and be supplanted by new and different systems only after it has been definitely proven that the new way is better.

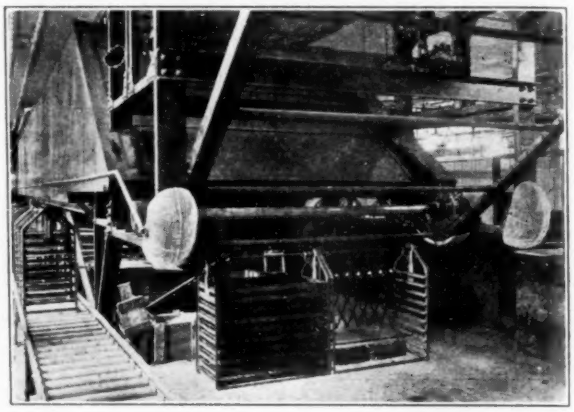
Under this premise it is not hard to understand why the commercial and industrial institutions of the country as a whole have been so slow, apparently, to adopt electric



SHERARDIZING. FURNACE SIZE, 4½ FT. X 27 FT. 3½ FT. HIGH. CONNECTED LOAD, 147 KW. OPERATING TEMPERATURE, 750° F.

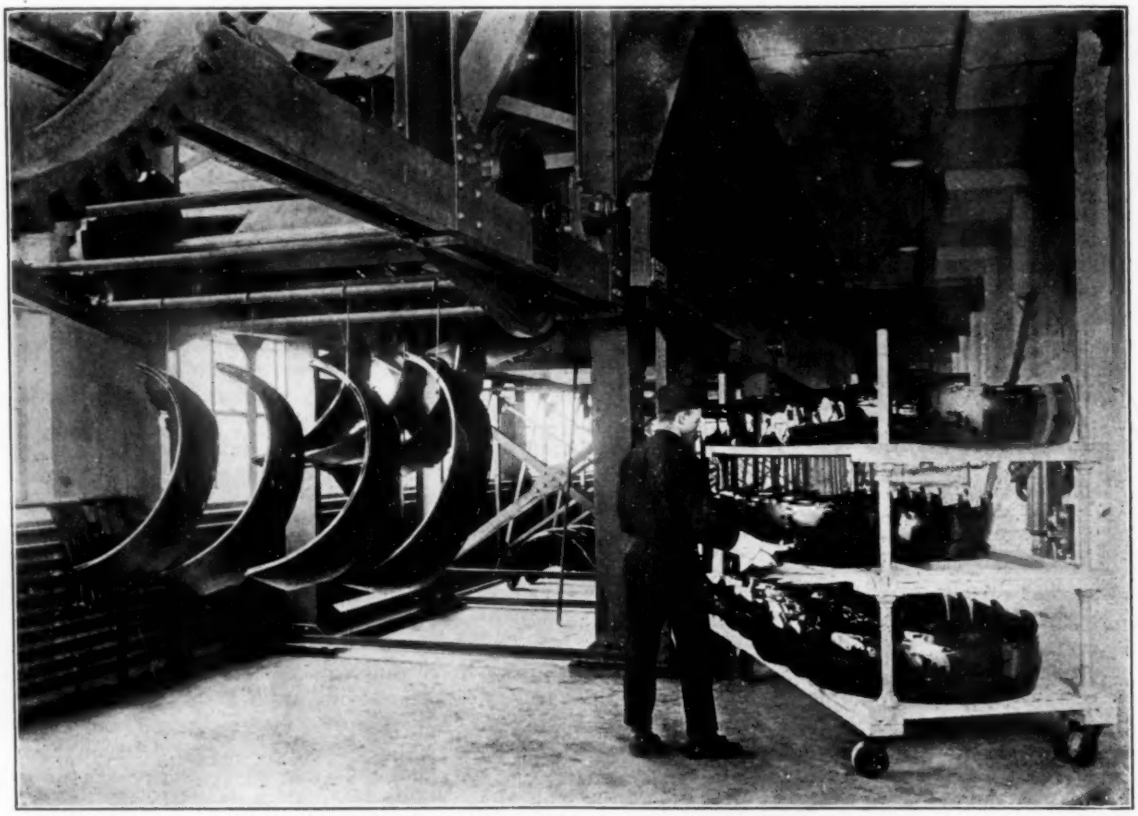
heat for their processes. At the same time considering the relative state of this branch of the electrical art compared with the older branches, phenomenal strides in industrial electric heating have been made in the last decade.

This very fact of rapid growth is in itself more or less



BAKING ENAMEL ON CAMERA PARTS. CONNECTED LOAD, 108 KW.

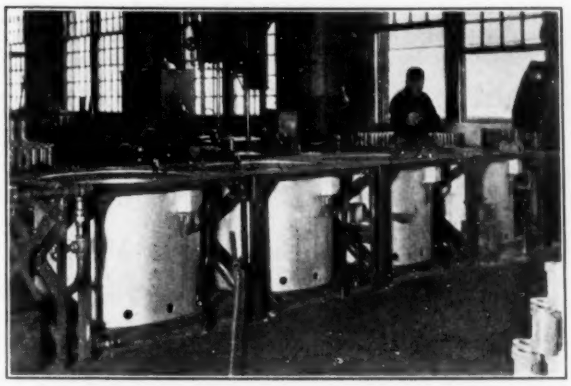
proof that industrial electric heating has both commercial and economic merit. In this paper an attempt is made to point out a few of the steps in the development of industrial electric heating, the reasons for this work and what the general plan of future development appears to be; dealing with resistance type heating medium almost entirely.



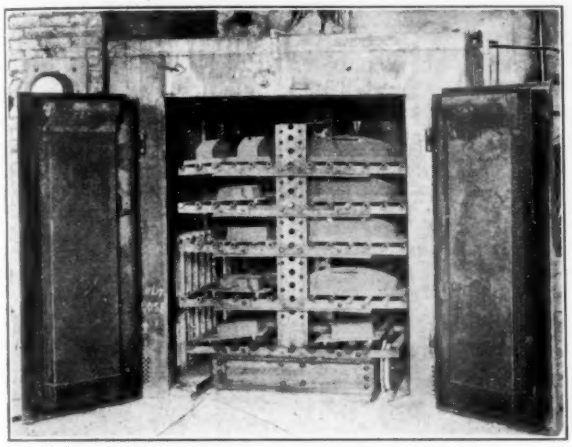
JAPANNING AUTOMOBILE FENDERS AND HOODS, ETC. PREHEAT OVEN—9½ FT. X 20 FT. X 7 FT. HIGH; FIRST COAT OVEN, 9½ FT. X 37 FT. X 7 FT. HIGH; FINISHED COAT OVEN, 9½ FT. X 60 FT. X 7 FT. HIGH. CONNECTED LOAD—500 KW., TOTAL OPERATING TEMPERATURE, 400° F.-450° F.

But a little more than ten years ago, electric heat was considered impractical except for small utensils such as flatirons, percolators, toasters, etc., where appearance and convenience were more important than anything else; or for large arc furnaces where extremely high temperatures were required such as carbide-carborundum and special alloy furnace processes.

As the latter field was quite limited, the natural trend of development was along the lines of appliances, resulting in the highly practical, standardized electrical appliances on the market today. This naturally stimulated a demand for small electrically heated utensils such as gluepots, solder pots, solder irons, chocolate warmers, tailors' and hatters' irons. These first devices, while poorly designed and requiring considerable repair service, soon demonstrated the practical nature of electrically heated apparatus and created an increasing demand for better and larger devices until today there is scarcely an industrial heating process to which electrically heated apparatus cannot be successfully applied.



BABBITT MELTING POTS. OPERATING TEMPERATURE, 900° F. CAPACITY OF EACH, 1500 LBS., 25 KW.



BAKING SMALL CORES AND MOLDS. OVEN SIZE, 6 FT. X 8 FT. X 6 FT. HIGH. CONNECTED LOAD, 65 KW. OPERATING TEMPERATURE, 450° F.

Table I gives a list of industrial applications which are now being successfully carried on by electric heat. While only partially complete, it will indicate those general applications which have been proven successful, so that no one will be taking a great risk by making such an application. Also this list indicates those applications which are being covered by standard existing apparatus which will allow one to determine at once whether the application in mind will require new development work.

A few years ago some of the promoters of electric heating took the stand that all industrial heating processes were suitable for electric heat, and even this statement is occasionally heard, but in general heating engineers are beginning to realize that while practically all heating processes can be done electrically, there are many which are neither practical nor economical with present relative fuel costs and the present state of the art.

NOMENCLATURE

Standard: Apparatus fully developed.
Special: New apparatus. Development charges perhaps involved.
Either: The application may be such as to permit the use of standard apparatus, or may require special apparatus.
Desirable: Good business economically.
Undesirable: Not good business at the present time.
Questionable: May be either desirable or undesirable depending upon local conditions. Not a sufficient number of installations made to be able to properly classify it.

TABLE I

Applications	Apparatus	Temp. Range Deg. Fahr.	Load Range K.W.	Power Factor Per Cent	Standard or Special	Status from Elec. Mfrs'. Standpoint	Status from Users' Standpoint
Aluminum Annealing	Oven or Furnaces	700 to 800	50 to 300	99 plus	Standard	Desirable	Desirable
Brass and Copper Melting	Arc and Induction Furnace	2100 to 2400	50 to 1000	60 to 92	Both	Desirable	Desirable
Core Baking	Baking Ovens	300 to 500	10 to 500	99 plus	Standard	Desirable	Questionable
Copper and Brass Annealing	Ovens, Oven Heaters, and Furnaces	1000 to 1300	10 to 300	99 plus	Standard	Desirable	Desirable
Chemical Liquid Heating	Hot Plates, Immersion Units, etc.	200 to 600	1 to 10	99 plus	Standard	Either	Questionable
Ind. Drying Ovens	Ovens and Oven Heaters	100 to 500	1 to 200	99 plus	Standard	Desirable	Desirable
Enamel Oven Heating	Ovens and Oven Heaters	150 to 500	5 to 2000	99 plus	Standard	Desirable	Desirable
Furnace Lining Drying	Oven Heaters and Spec. Heaters	500 to 1000	5 to 100	99 plus	Both	Either	Questionable
Glue Cooking	Glue Cookers and Pots	150 to 200	1/10 to 2	99 plus	Standard	Desirable	Desirable
Lead Pot Heating	Furnace Elements	1400 to 1800	10 to 100	99 plus	Both	Desirable	Desirable
Laboratory Furnace Heating	Furnaces	1000 to 2000	1/10 to 10	99 plus	Standard	Desirable	Desirable
Motor and Generator Warming	Cartridge and Steel Clad.	150 to 200	1 to 10	99 plus	Standard	Desirable	Desirable
Solder and Babbitt Melting	Solder, Babbitt, Pots and Furnaces	750 to 950	1/5 to 25	99 plus	Standard	Desirable	Desirable
Solder Iron Heating	Solder Irons, Furnaces, etc.	500 to 750	1/10 to 2½	99 plus	Standard	Desirable	Desirable
Water Heating	Immersion, Clamp-on Steel Clad	150 to 200	1/5 to 10	99 plus	Standard	Desirable	Questionable
Wire Annealing	Furnaces and Furnace Heaters	1400 to 1650	10 to 300	99 plus	Both	Either	Desirable

Applications of Metals

A Practical Description for the Foundryman and User of Metals of the Industrial Applications of Metals and the Principal Uses and Properties of Their Alloys. Conclusion.*

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SILICON BRONZE

Silicon bronze usually contains about 97.3 per cent copper, 1.2 per cent zinc, 1.3 per cent tin and 0.05 per cent of residual silicon. In cast shapes, this bronze has a tensile strength above 50,000 pounds, elongation of approximately 18 per cent and 40 per cent reduction of area. Its principal use is for electrical purposes where its high conductivity combined with great strength give it an advantage over any other bronze. Also it resists atmospheric corrosion well, and is extensively rolled into telegraph and other wires.

BEARING BRONZES

Bearing bronzes include that very large class of machine bronzes used under widely different conditions of pressure, speed, temperature and corrosion, for bearing purposes, as might be supposed, this has resulted in the numerous compositions. Where only thin sections are permissible and a maximum amount of strength is required as in motor armature and axle bearings, compositions similar to the phosphor bronze previously referred to are used.

These often are varied by the addition of nickel and small quantities of a number of other elements. However, on quite a large class of general bearings, the increased wear and anti-frictional properties which lead will impart to a bearing composition, if thoroughly mixed, it is generally desired to incorporate as large a percentage of this metal as casting conditions will permit, still retaining sufficient strength to meet the compressive strains and shocks to which this type of casting is subjected in service. Normally, for sand cast bearings, this maximum occurs at about 16 per cent of lead, so that a typical specification for locomotive bearings will require a composition of not less than 75 per cent copper; not less than 8 per cent tin; not less than 10 per cent lead; not more than 15 per cent or less than 3 per cent of zinc, and less than 1 per cent of other elements. This metal will stand a deflection about 1 inch on a 1 inch bar with 9 inch supports, before fracture, has a tensile strength of about 21,000 pounds and an elongation of 9 per cent in 2 inches. Special processes of castings, however, admit of the incorporation of lead in percentages as high as 25 to 30 per cent, and still a structure is obtained which is as strong as the normal composition cast in sand.

If, when melted, these alloys can be considered as being solutions of one metal within another, then the phenomena which take place during the solidification and cooling of the solutions naturally affect the resultant properties after solidification. Hence, on account of the many graduations in cause and effect, in modern plants for the production of high-grade bronzes where fixed standards are required to be maintained, the results are checked in four different, but almost equally important ways, namely, by chemical analysis, microscopic examination of structures formed, examination of the phenomena of solidification and fusion, and the physical characteristics of the alloys.

* Part 1 was published in our issue of January, 1926.

SILICON IN THE FOUNDRY

SILICON COPPER, 5-10-15-20-25-30 AND 50 PER CENT

Every brass, bronze, and copper founder has experienced the difficulty of obtaining perfectly sound castings free from flaws and blowholes. The molten metal dissolves gases but upon cooling and solidifying the oxygen is again set free, the natural consequences being that the gas remains in small bubbles throughout the solid metal, each bubble being a small blow hole or flaw. These blowholes and flaws, of course, weaken the metal considerably.

Silicon added in the form of silicon copper combines with the oxygen in the occluded gases, and thus removes blowholes. Only a very small quantity of alloy is required to be added to the metal.

This alloy is also used for solidifying castings and hardening common brass. It is useful in remelting scrap brass.

In wire drawing, the advantages of adding silicon to the metal are obvious. Silicon added to the metal for manufacturing purposes, viz., telephone wires, electric cables, and wire for all electrical purposes, materially increases the breaking strain without impairing the conductivity.

It is most useful for copper zinc alloys, 30 per cent of zinc and upwards. It will reduce oxides and help to produce a casting with an even, smooth grain, free from blowholes and sandholes.

METHOD OF USING

In actual practice it is found better to add it while the crucible is in the furnace, a few minutes before withdrawing the crucible, so as to allow the copper silicon to melt and become thoroughly incorporated in the molten mass. The metal should be well stirred, a handful of green sand thrown upon the surface, and then carefully skimmed. The sand will help to gather up oxides and dross which the silicon copper has released. The metal is then ready for casting.

QUANTITY TO USE

FOR COPPER CASTINGS

Si. 10 per cent, 10-ozs. of alloy to 100 lbs. metal
Si. 25 per cent, 6-ozs. of alloy to 100 lbs. metal
Si. 50 per cent, 3-ozs. of alloy to 100 lbs. metal

FOR GUN METAL AND BRASS CASTINGS

6 ozs. to 100 lbs. metal
4 ozs. to 100 lbs. metal
1½ ozs. to 100 lbs. metal

The use of silicon copper in the brass foundry as a flux and deoxidizer has found much favor for certain classes of work. Its action as a flux is similar to aluminum, but it will not cause so great a shrinkage as aluminum.

MANGANESE

Manganese is used in small proportions as a deoxidizer and hence is an aid to the production of sound castings. When a sufficient quantity of this metal is used, so that residual increments remain in the bronze, the tensile

strength is increased. Also, the elongation is reduced, but this reduction is not proportional to the increase in strength, so a small percentage in a broze of normal composition acts as a toughener.

MANGANESE COPPER

Manganese copper is made in two grades, both containing 30 per cent of manganese.

No. 1 grade is made from the pure manganese and lake copper. It is practically free from iron and other impurities. It is used for introducing the manganese in making manganese bronze, also for adding in small amounts to brass and bronze as a deoxidizer.

No. 2 grade contains 3 per cent of iron in addition to the 30 per cent of manganese. This is largely used for making some grades of manganese bronze, and for other purposes where the iron is not detrimental.

USE OF PHOSPHORUS

The principal use of phosphorus is as a deoxidizing agent, since oxygen and its compounds form one of the most serious detriments to the production of sound, strong castings free from blowholes. Although phosphorus is seldom found in the metal, except in small proportions, it is a very important element. Besides acting as a flux, it makes the metal run more freely and helps it to become thoroughly alloyed. Phosphorus when remaining in the metal, acts as a decided hardener, and in consequence of this, the tensile strength is increased and the elongation diminished. Tests have proved that where the percentage of tin in the bronze is low, residual phosphorus increases the rate of wear, but where used in bronzes having a high tin content, the rate of wear is materially decreased. Its specific gravity in the yellow stick form is 1.84, and the melting point is 111° Fahr.

Phosphorus is usually introduced as phosphor copper, containing 15 per cent phosphorus, and comes in caramels or shot form.

NICKEL

Nickel is a metal which is closely allied to iron and is of a slightly lighter color. It is an ingredient of valuable alloys such as German silver, coinage, nickel steel, etc.

Nickel is very difficult of fusion, melting at about 2800° Fahr. It is attracted to the magnet and may be made magnetic like iron. Nickel is used in minor percentages in some special bronzes, since it sets quickly, thus aiding to form a dense, close-grained structure and helps to lower the rate of wear.

Copper nickel, 50-50 shot, is the most convenient and economical way to make nickel bronzes, as this alloy melts as readily as copper and the chances of destroying linings of furnaces and crucibles due to the high melting point of nickel are eliminated.

When 3 to 5 pounds of this alloy are added to the 100 pounds of high lead or so-called plastic bronzes and anti-acid alloys, lead sweating is completely stopped. Alloys of copper and lead in any proportion up to 40 per cent lead can be satisfactorily cast.

When 2 to 3 pounds are added to 85-5-5-5 and other valve and pressure alloys the grain is intensified, the number of leakers are materially reduced, tensile strength increases without injuring the machineability.

It is a cleansing agent and should be charged into the pot or furnace at the beginning of the melt. The alloy contains fifty per cent each of copper and nickel.

ALUMINUM

Aluminum is a metal of silver white color and brilliant luster, very maleable, ductile and a good conductor of heat and electricity. It melts at about 1160° Fahr. Its most remarkable features are (1) its low specific gravity, about 1/3 that of iron; (2) its strength; (3) that it does not tarnish in the air. It is non-poisonous; it is used in machinery and alloys, and in apparatus where lightness and strength are required.

Aluminum is widely used by steel makers to quiet the metal before pouring, enabling them to produce better steel castings. It is alloyed with small amounts of tin, zinc, copper and silicon to form numerous alloys. Aluminum either cast or rolled is used for machine parts in which weight is objectionable, and in which great strength is not necessary, such as crank and gear cases for automobiles, vacuum cleaners, etc. Its electrical conductivity is about 60 per cent that of copper. This fact combined with light weight and fairly high tensile strength has made it useful for transmission of electricity. The burden put on the supporting towers and poles of an electrical power transmission line by the dead weight of wire, is about 40 per cent that of copper. It is used largely for cooking utensils on account of its high resistance to corrosion. Five per cent of copper, nickel or manganese, or 30 per cent of zinc added to aluminum make strong metals, as rigid as bronze, yet only one-third as heavy. Such light, strong, good casting and machining alloys have an extremely large field of usefulness.

The three principal forms in which aluminum is sold, are as follows:

99 per cent pure aluminum—Aluminum, 99.28; Silicon, 19; Iron, 21; other impurities, .17.

This is the highest grade aluminum obtainable—malleable, homogeneous, doubly refined, superior in working qualities to the ordinary 98-99 per cent aluminum. It is largely used for die casting alloys and other specialties, where purity is of prime importance; sold in notched bars, ingots and pigs.

98-99 per cent. aluminum—Silicon, .37; Manganese, .02; Iron, .29; Copper, .21; Zinc, .11; Aluminum, 98.67.

This is for general casting alloys of aluminum and deoxidizing steel. It meets all the commercial requirements of the foundryman. Foundrymen who prefer to make their own alloys can do so by adding varying percentages of other elements to this grade. It is sold in notched bars, ingots and pigs.

No. 12 alloy—Aluminum, 91 plus; Iron, Under 1½; Copper, 5 plus; Silicon, Under 1¼; Zinc, under 1½; Manganese, under 1/10; Magnesium, under 15 per cent; total impurities less than 3 per cent.

About 95 per cent of the output of sand castings is poured from this alloy. It is most suitable for general run of castings; sold in notched bars, ingots and pigs.

COPPER ALUMINUM 50-50

Pure aluminum is not satisfactory for castings, owing to lack of strength. To give the required strength and hardness, alluminum is alloyed with copper, zinc, manganese, magnesium, and sometimes with other of the rarer metals.

The most widely used alloys for ordinary casting work, such as motor engine crank cases, etc., is aluminum with small percentages of copper, or copper and zinc.

As the melting point of copper is so much higher than that of aluminum, it is practically impossible for the ordinary foundry to introduce exact proportions of metallic copper with a certainty of reliable results. In using metallic copper it is necessary to first melt the small amount of copper in the pot, and then when molten, add the aluminum. A large proportion of the copper is absorbed by the crucible and is lost, and owing to the high temperature of the molten copper, the aluminum is raised to too high a temperature, resulting in the formation of

aluminum oxides (alumina) which is infusible and remains in the finished casting. This causes loss of strength and failures.

To overcome these difficulties, and make it possible for any foundry to produce sound and strong castings containing the exact percentage of copper required, an alloy containing 50 per cent aluminum and 50 per cent copper is used. This alloy dissolves readily in molten aluminum without loss. To produce a casting containing say, 98 per cent aluminum and 2 per cent copper, all that is necessary is to melt 96 lbs. aluminum, and when molten, add 4 lbs. of the 50-50 alloy, which immediately dissolves. Stir well and cast. The resulting casting will contain the exact proportions of aluminum and copper required, and will be free from oxides.

SILICON-ALUMINUM 50-50

This is used to make definite additions of silicon to aluminum alloys. Silicon-aluminum added in the proportions of 2 to 4 pounds to the hundred of No. 12 alloy eliminates top shrinkage, making it unnecessary to use chills, large gates and risers. Castings with thick and thin sections can be cast readily and with greater density of structure. Silicon-aluminum alloys are quite resistant to certain types of corrosion. Silicon densifies the structure and eliminates porosity.

It is used in the manufacture of die castings, to do away with hot shortness and cracking. For this purpose, four pounds of silicon-aluminum is used to the hundred pounds of aluminum melted. When using No. 12 aluminum alloy for patterns, 2 per cent of silicon-aluminum should be added and a very sharp pattern will result. It should be added to the molten aluminum and stirred in well until it dissolves.

Some interesting alloys are as follows:

Pure Aluminum	Alloy aluminum silicon 50-50	Aluminum Copper 50-50	Tensile strength lb. per sq. in.	Elongation in 2"
90	10	..	20,000	4.0
84	16	..	19,000	5.0
80	4	16	22,000	2.5
84	8	8	21,000	3.5
80	16	4	22,000	3.0
70	18	12	25,000	2.0
70	26	4	21,000	6.0
56	24	20	26,000	2.5
74	26	..	19,000	6.0

MANGANESE ALUMINUM 25-75

Manganese aluminum is used to make definite additions of manganese to various aluminum alloys, readily soluble in molten aluminum.

NICKEL ALUMINUM 20-80

Nickel aluminum 20-80 is used for making definite additions of nickel to aluminum alloys. It is readily soluble in molten aluminum. Small percentages added to No. 12 and other aluminum alloys eliminates hot shortness, gives easier casting qualities and produces a fine white surface which is very easy to polish or machine.

FERRO ALUMINUM 20-80

For use in cast iron; this makes cleaner, more solid and softer castings, reducing the percentage of defective castings. It is a more economical way of adding aluminum as a deoxidizer in cast iron.

The percentage of iron contained in this aluminum alloy, tends to carry the aluminum into the molten metal with the minimum of metal loss and maximum of deoxidizing efficiency.

ANTIMONY

Antimony is a metal of which color and bright luster, and does not readily tranish. It is a less perfect conductor of heat and electricity than most true metals and also differs from them in being brittle. It melts at 842° F., and has a specific gravity of 6.7 heavier. It is largely used in alloys particularly type metal, babbitt and various anti-friction metals. Antimony in small percentages is sometimes used as a hardener, and it also yields a close-grained bronze. It rapidly increases the tensile strength and lowers the elongation.

BISMUTH

Bismuth is a metal of peculiar light reddish color, highly crystalline, and very brittle. It is used in alloys with tin and lead, which fuse at a temperature less than that of boiling water and steam, under pressure, i. e., such an alloy as is used in what are called "Safety Plugs," put in the shells of steam boilers to indicate low water.

SOLDER

Solder is an alloy of tin and lead, extremely fusible; it is generally used for joining or binding together metallic joints or surfaces.

BABBITT

This is an alloy composed of tin, copper, lead and antimony. Any anti-friction metal has now come to be known as "Babbitt metal." Formerly the alloy originated by Isaac Babbitt was used for all purposes, but there is no one composition that will bring equally good results in all kinds of machinery. A metal designed to do the best service under heavy pressure will not be the best metal for bearings subject to high speed.

BORON

The use of boron alloys has received a great deal of prominence of late, due to the remarkable results obtained in its use, for degasifying and densifying brass and bronze alloys. The sudden demand for the boron alloys, has undoubtedly been caused by the research work being done at the University of Wisconsin, and the General Electric Laboratories.

CHROMIUM

This element has been used recently in nickel copper alloys to increase tenacity and resistance to corrosion. Some experiments are being carried on toward the use of chromium in aluminum to increase tensile strength and elongation.

MAGNESIUM

Magnesium is manufactured by a process similar to aluminum, and is used to make alloys with aluminum, which are lighter than aluminum, and make castings as strong as brass or bronze.

MERCURY

Mercury is a metal of silver white color and brilliant metallic lustre, unique in that it is fluid at all ordinary temperatures. Its chief use is in treating gold and silver ores, and its peculiar quality is availed of in the thermometer and barometer.

AMALGAM

This term signifies a mixture of quicksilver with another metal. Amalgams are used for cold-tinning, water gilding and for the protection of metals from oxidation.

TITANIUM

Titanium, while acting apparently in much the same way as manganese, is even more powerful in its effect, and hence a solid, strong, tough bronze may be obtained by its judicious use.

IRON

Iron is usually present in bronzes in small amounts, in some instances merely as an impurity and in other notable bronzes is purposely added. If thoroughly alloyed with the copper it tends to increase the strength and hardness at the expense of elongation.

Smelting Secondary Aluminum and Aluminum Alloys

A Series of Articles on the Reclamation of All Forms of Scrap and Used Aluminum and Aluminum Alloys. Part 3. Constitution and Evaluations of High Aluminum Scraps*

Written for The Metal Industry by Dr. ROBERT J. ANDERSON, Consulting Metallurgical Engineer

Considerable uncertainty exists as to the actual chemical constitution of drosses derived on melting aluminum and the various aluminum alloys, and in practice the chemical composition of the oxidized part of the dross is generally ignored. The secondary smelter is usually concerned only with the free metal content and the composition thereof. As explained in a previous article, aluminum dross consists roughly of aluminum oxide, Al_2O_3, plus metallic aluminum mechanically entangled therewith. In the same way, aluminum-alloy dross consists of aluminum oxide (plus other oxides such as copper oxide, silica, zinc oxide, etc.) plus metallic aluminum alloy mechanically admixed. The amount of metallics in drosses and skimmings may be very variable—from 10 to 60 per cent, depending upon the origin of the dross, the flux used in melting, and the care employed in skimming. Some so-called bright drosses from holding pots may run 90 per cent recoverable metal.

Not many published analyses have appeared giving the chemical constitution of aluminum-bearing drosses, possibly because of the sampling difficulties involved, and most of those given appear to be quite incomplete. A typical analysis of an aluminum-alloy dross slagged off from the ordinary smelting operation on light alloy borings is given in Table 1. The material was first screened to remove any metallics. As received, the sample contained 6.82 per cent volatile matter. The analysis given in Table 1 was on the dried sample. The nitrogen content of the sample was not determined.

Dross skimmed from melting charges after fluxing with zinc chloride is fluffy, loose, and light (i. e., as skimmed), and it may contain a relatively small percentage of admixed metal. The heavy dross taken off holding pots or from melting charges just before pouring (having previously been fluxed and then allowed to stand) is bright and contains a high percentage of recoverable metal.

Several methods have been devised for the analysis of aluminum-bearing drosses, but details of sampling procedure have not been supplied with these published methods. While the methods referred to are entirely satisfactory for the chemical analysis of the actual oxidation product, the usual commercial drosses and skimmings are sampled with difficulty and large lots must be handled. Typical methods of analysis for aluminum-bearing drosses have been described by Bezzenberger[1] and by Hiller[2]. In the case of material which contains practically no entangled metallics, and especially light fluffy drosses as well as a mixture of dross and skimmings after long weathering, representative samples can readily be secured. But where there is much metal present, the fire assay is the only reliable method of evaluation for free metal content. In the purchase of drosses, the fire assay serves as a guide to the possible recovery on smelting. In buying or selling drosses and other scraps the only fair basis is the recovery obtainable. The fire assay is a miniature smelting run on a representative sample of sufficient size, and in some cases several runs may be made on grab samples taken from different parts of a lot or shipment.

TABLE 1
Chemical Composition of Dross from the Smelting of No. 12-alloy Borings.*

Constituent.	Per Cent.
Silica	14.23
Copper oxide	4.47
Iron oxide	13.43
Aluminum oxide	64.70
Zinc oxide	3.04
Total	99.87

*Volatile matter 6.82 per cent.

SAMPLING AND ASSAY OF DROSSES

Price quotations on lots of dross for sale may be made on the basis of the fire assay. A sample of about 1 lb. which is representative of the material offered can be run but larger samples are better. With carload lot shipments, the lot may be sampled as follows: A small shovelful, or handful, of the material is taken from each unit load (e. g., wheelbarrow load) removed from the car, so that 200 to 300 lbs. are obtained. If there are large and heavy pieces in the shipment, one or more of such pieces should be taken from each load, depending upon the proportion of large pieces in the lot. The large sample of 200 or more lbs. obtained from the car is broken down with sledge hammer or crushed as may be required, so that the largest piece is not over ½ inch in diameter. About 1 lb. of this crushed sample is taken by ordinary sampling procedure, evaluated by the fire assay, and the resultant metal analyzed for chemical composition.

About 200 lbs. of the large sample is run through a suitable crusher (if not previously crushed), e.g., a swing-hammer pulverizer, screened, and then run over a magnetic separator to remove iron. The material after this treatment is run down in a furnace by the ordinary smelting operation so as to obtain a check against the fire-assay result on the small sample. Some firms prefer to run down about 1 ton of dross or other scrap in order to arrive at a representative recovery figure in making quotations.

The 1-lb. sample which is to be evaluated by the fire assay is sent to the laboratory, ground down in a mortar with pestle until the aluminum oxide and dirt adhering to the metal have been loosened and the largest pieces are about ¼-inch in diameter. Then about ½ lb., or half of this sample is screened through a 30- or 40-mesh screen, the other half being reserved. The fines are discarded, and the oversize is gone over with a magnet to remove free iron. Calculation is made for the free iron content. The aluminum or alloy content of the sample is then determined by running down the material left on the screen in a small graphite-clay crucible in a small furnace. A No. 2 crucible may be used. The crucible is charged with about two-thirds of the sample, and the

*Parts 1 and 2 were published in our issues of January and September, 1925.

[1] F. K. Bezzenberger, The evaluation of aluminum dross, Jour. Ind. and Eng. Chem., vol. 12, 1920, pp. 78-79.

[2] H. Hiller, Ueber die Analyse von Aluminiumasche, Zeit. für angew. Chem., vol. 33, 1920, pp. 35-36.

mass is puddled with a small tool as it heats until the temperature is a full red. The charge decreases in volume on puddling and heating, and the remainder of the sample is added. When the whole charge has been worked up by puddling and raised to about 700° C., about one-half teaspoonful of cryolite is added as a flux, and the mass is puddled continuously until a thermit-like reaction begins. The crucible is then removed from the furnace, and the dross on top of the bath of metal skimmed off. The metal is poured into a small iron mold, care being taken that no small beads of metal are lost by occlusion in the dross remaining in the crucible. The crucible is scraped cleanly to remove all metal and dross. The dross is air-quenched on an iron plate, and then screened, when cold, through a 30- or 40-mesh screen. The material remaining on the screen is returned to the crucible, reheated, and worked, giving additional metal. The total weight of metal obtained gives the recoverable metal content of the dross sampled, and chemical composition of the metal or alloy is determined by analysis of drillings from the small ingot poured.

Determination of the metal content of drosses by the above described fire assay should check fairly closely with the recovery obtained by smelting large lots in the plant.

Table 2 shows the results of a fire assay on a sample of dross. The material contained 56 per cent recoverable metal, and no free iron. The composition of the alloy content of the dross is shown.

TABLE 2

Results of Fire Assay and Anaylsis on Sample of Dross.

Item	Per cent.
Metallic content	56
Magnetic iron	None
Copper	12
Iron	1
Zinc	40
Aluminum (by difference)	47

SAMPLING AND ASSAY OF BORINGS

In a general way, borings are sampled and evaluated in a manner similar to that described above for drosses and skimmings. In the case of carload lots, a grab shovelful or handful is taken from each unit load (wheelbarrow load) removed from the car, a sample of about 200 lbs. being taken. This large sample is thoroughly mixed, and then quartered down. A sample of about 1 lb. is taken for the fire assay, and the remainder reserved for a smelting run. In the case of the fire assay, half of the 1-lb. sample is treated with a magnet, and the free iron determined. The remainder is run down in a small crucible in the manner described above for drosses, and the recoverable metal content ascertained. The oil and volatile matter (in the case of oily or wet borings) may be determined on the other half of the 1-lb. sample, so that the recovery on the basis of the metal content of the borings may be calculated. The actual recovery of metal from borings on smelting large lots, as is the case with drosses, may be expected to be a little higher than the recovery given by the fire assay.

Table 3 gives a typical report on a lot of borings.

EVALUATION OF ALUMINUM-BEARING SCRAPS

The evaluation or estimation of the recoverable metal in a lot of aluminum-bearing scrap is done on the basis of the metallic content and chemical composition of the metal obtained from the material to be purchased. Prices are usually quoted f.o.b. point of receipt. The following gives an outline of the method of estimating quotations on drosses. It may be assumed that the results of the fire assay and analysis were as shown in Table 4. It may also be assumed that it is desired to work the dross in with other scrap or new metal to make a secondary casting alloy, using some of the copper, iron, and zinc, and all of the aluminum present. The extra amounts of the copper, iron, and zinc above the percentages required to make a modified No. 12 alloy are of value only as scrap metals of the several kinds. The following calculations will obtain:

TABLE 3

Results of Fire Assay and Analysis on Sample of Borings.

Item	Per Cent
Oil	3
Dirt	6
Metallic content	88
Magnetic iron	3
Copper	8.4
Iron	0.9
Zinc	0.4
Aluminum (by difference)	90.3

TABLE 4

Results of Fire Assay and Analysis on a Dross, for Making Price Quotation.

Item	Per cent.
Metallic content	54
Magnetic iron	None
Copper	14
Iron	0.8
Zinc	40
Aluminum (by difference)	45.2

TABLE 5

Distribution of Metals for Evaluation on the Basis of 100 Lbs. of Dross.

Item.	Metal in the Dross, Lbs.	Metal in the No. 12 Alloy, Lbs.	Metal to Be Evaluated, Lbs.
No. 12 alloy	....	....	27.0
Copper	7.6	1.9	5.7
Iron	0.4	0.2	0.2
Zinc	21.6	0.5	21.1
Aluminum	24.4	24.4	....
Totals	54.0	27.0	54.0

100 lbs. of dross contains 54 per cent, or 54 lbs. of alloy.

45.2 per cent of this 54 lbs. of alloy is aluminum for the No. 12 alloy, or 24.4 lbs.

The No. 12 alloy is to contain 7 per cent copper, 0.8 per cent iron, 2 per cent zinc, and remainder aluminum (90.2 per cent).

$$\frac{24.4}{90.2} = 27$$ lbs. of No. 12 alloy can be obtained from the aluminum in the recoverable alloy of the dross.

The No. 12 alloy will contain the following amounts of the different metals:

Copper	0.7x27 =	1.9 lbs.
Iron	0.008x27 =	0.2 lbs.
Zinc	0.02x27 =	0.5 lbs.
Aluminum		24.4 lbs.
Total		27.0 lbs.

Now, 54 lbs. of alloy obtained from 100 lbs. of dross contains the following amounts of the several metals:

Copper	0.14x54 =	7.6 lbs.
Iron	0.008x54 =	0.4 lbs.
Zinc	0.40x54 =	21.6 lbs.
Aluminum	0.452x54 =	24.4 lbs.
Total		54.0 lbs.

The distribution of the metals for evaluation on the basis of 100 lbs. of dross is given in Table 5. The value of metals in dross or skimmings is determined by con-

sidering No. 12 alloy at the sales price and copper, iron and zinc at their cost prices at scrap. The value of the lot of dross, therefore, is as given in Table 6. The cost of handling plus overhead plus profit on the type of dross in question is placed at $0.10 per lb. of metal produced. Hence, in order to smelt 100 lbs. of the dross, it would cost $0.10x54 = $5.40. The price that can be quoted on this dross, then, is the difference between the value on selling and the cost of producing, or

$9.295
5.40

3.895 per 100 lbs. or

$$\frac{3.895}{100} = \$0.038 + \text{ per lb.}$$

A quotation of 3¾ to 4 cts, per lb. would be made on this type of material. The relatively low value of this dross is owing to the high zinc content and the utilization of the dross for working into the No. 12 alloy. Aluminum dross (from the melting of commercial aluminum) may command a price of 5 to 8 cts. per lb. for relatively inferior grades up to 15 cts. or more for the higher grades of clean skimmings. Borings sell for 13 to 17 cts. per lb. in the present market.

In making quotations on drosses, borings, and other scraps, the smelter must take into account the market for secondary metal or alloys, the recoverable metal in the scrap, the chemical composition of such recoverable metal, freight rates, and other items. The sale and purchase of scraps should be made on the basis of possible recovery (taking into account the chemical composition of the material) rather than by estimation of how much a lot may be worth by visual examination.

TABLE 6

Value of Lot of Dross.

Item.	Cost per Lb., $.	Pounds of Metal in the Dross.	Value of the Metal per 100 Lbs. of Dross, $.
No. 12 alloy	0.26	27.0	7.020
Copper	0.14	5.7	0.798
Iron	....	0.2	.....
Zinc	0.07	21.1	1.477
Totals	....	54.0	9.295

The fourth article in this series will deal with fluxes used in secondary smelting of aluminum-bearing scraps.

Aluminum Paint

The employment of aluminum paint for both inside and outside work in place of the usual paints is greatly increasing in the United States. Although aluminum paint has been employed for many years, the great expansion in its use has come in the past two years.

The aluminum powder for aluminum paint is made by stamping thin aluminum sheet or foil into minute flakes in a progressive stamping process. The small particles of metal are screened to various sizes and form the aluminum powder of commerce. This powder is mixed with suitable vehicles, such as linseed oil of heavy body, spar varnish, lacquers, amyl acetate, and other bases, to form the paint. Aluminum powder for paint is furnished as polished and unpolished; the polished powder yields a highly reflecting and brilliant surface as a paint.

Aluminum paint is valued for its great opacity, high reflectivity, corrosion-resisting and heat-insulating properties. It has great covering capacity, a gallon of the paint ordinarily covering about 750 square feet of surface.

Aluminum paint is now being used very generally as an outside paint for painting equipment in oil refineries, gas holders, structural steel work, in by-product coke plants, smoke stacks (both on land and on vessels), towers, water plugs, transformer tanks, and other purposes. When used for oil storage tanks, aluminum paint serves the double purpose of protecting the steel of the tank against corrosion and maintains the temperature low under exposure to the sun, reducing volatilization.

A coat of aluminum paint applied to an automobile top shuts out 50 percent of the heat from the sun, and a coat applied to the underside of a tent shuts out about 85 percent of the sun's heat rays. A black automobile top absorbs about 90 per cent of the sun's rays and about half of this heat is re-radiated from the underside. Aluminum paint is used to paint the fabric of balloons and of the rigid type of dirigible ship like the Los Angeles, the object being to keep the inside cool and to protect from the action of the weather.

Aluminum paint is coming in considerably for use in covering interiors, particularly in factories and foundries. The reflectivity of aluminum paint for light may be as high as 70 per cent, i.e., about 70 per cent of the light striking a surface painted with aluminum is reflected and the remaining 30 per cent is absorbed.—Dr. R. J. Anderson.

World Silver Output†

The lack of information covering both the amount of silver required for new coinage and the supplies of bullion made available by the melting and debasement of old coinage prevents an accurate compilation of figures showing world supply and demand. We have, however, prepared a table comparing our estimate for 1925 with that of 1924, all data being based upon the most reliable information available at this time:

WORLD SUPPLIES

(In millions of fine ounces)

Production:	1925	1924
United States	64.	65.4
Mexico	91.	91.5
Canada	19.	19.7
All other countries	64.	62.5
Total production	238.	239.1
Proceeds of debased coinage from England	7.	2.
Melted Continental coin	—	18.
Total	245.	259.1

WORLD CONSUMPTION

Shipments:	1925	1924
To India from the United States, Canada and Mexico	72.4	*81.2
To India from England	34.1	27.
To China from the United States, Canada and Mexico	52.7	*39.1
To China from England	6.5	2.6
To Germany from the United States and Mexico	14.5	—
Arts and Manufactures:		
In the United States	31.	28.
In England	5.	4.5
Coinage:		
U. S. Mint under Pittman Act	—	1.1
U. S. Mint—Dore bullion for subsidiary coinage	17.	3.3
Mexican Government	3.3	11.3
European countries	—	50.
Other Buyers:		
Origin and destination unknown	8.5	11.
Total	245.	259.1

*There were no shipments from Mexico to the Far East in 1924.

†From Handy & Harman's Review of The Silver Market for 1925. See page 72 of this issue.

The Plating Department of a Large Musical Instrument Manufacturing Plant

Written for The Metal Industry by ALLEN P. CHILD, Kansas City, Mo.

The plating departments of the C. G. Conn, Ltd., factories at Elkhart, Indiana, accomplish much work which requires a large daily expenditure of real money. Silver solutions valued at $6 a gallon with vats carrying 5,400 gallons are found here with 1,187 gallons of gold solution valued at $20 a gallon. The total value of the plating solutions is $56,140.

The instruments to be plated are brought on conveyers to the tanks containing the solutions and by agitating the pieces as they are carried around through the solution they will stand a much higher current without any danger of burning. The use of conveyers shortens the plating time as well. Automatic electrical measuring instruments on each tank give information to guide the operator in the electro-plating of the instruments and automatic thermostats control the temperature of the gold solutions which are used hot at their highest efficiency.

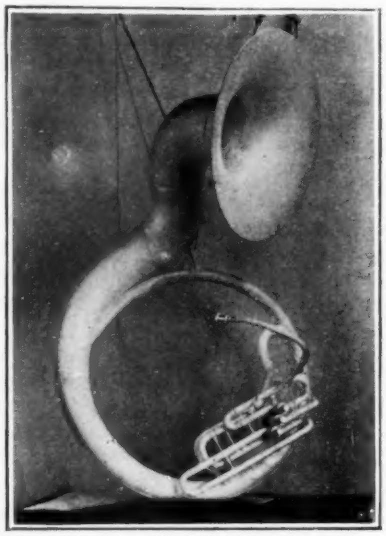

FIG. 1. A PLATED BAND INSTRUMENT

Fig. 3 shows the instruments for controlling the plating. This is claimed to be the first board of its kind ever installed in a plating department. The instruments give the exact weight of gold or silver deposited on each instrument being plated. The four small meters on the top row are Sangamo ampere-hour meters controlled individually of each other, recording the amount of deposit each instrument receives. The large meter records the total amount of gold or silver deposited. Of the two small meters in the center of the board the one on left (ammeter) gives the amount of current being used and also the amount of gold or silver being deposited per hour. The right one (voltmeter) indicates the volts.

Fig. 2 gives a general view of a musical instrument plating department. The ceilings are 16 feet high, with skylight dormers over the entire room, and large electric fans at each end. Floors are of concrete, with

FIG. 2. GENERAL VIEW OF A MUSICAL INSTRUMENT PLATING DEPARTMENT.

three drains, each running the full length of the large plating room.

Fig. 4 shows the plating tanks. These tanks have a capacity of 2,500 gallons of solution and 300 instruments a day may be plated in them. The advantage of the conveyor over the still tank is that the work is agitated as it is carried around through the solution and therefore stands a much higher current without any danger of burning. The conveyors shorten the operating time by one-third.

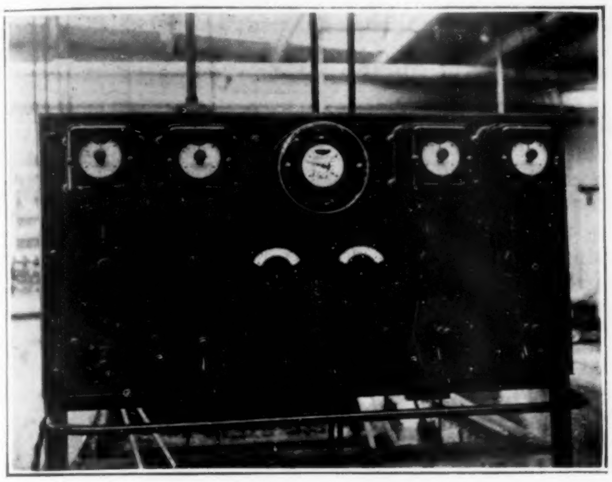

FIG. 3—CONTROL INSTRUMENTS FOR PLATING

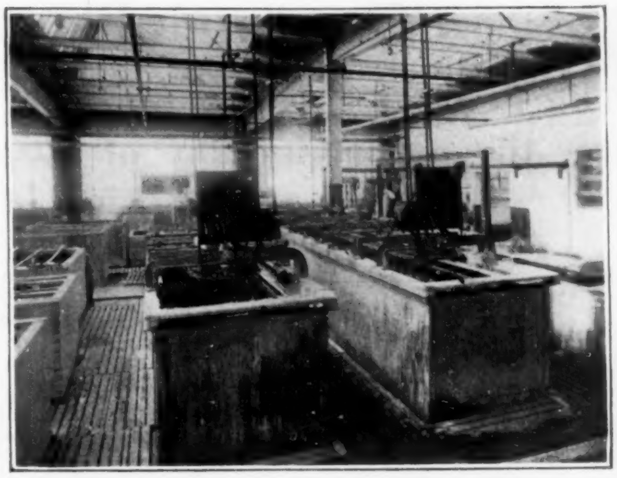

FIG. 4—PLATING TANKS

Fig. 5 illustrates the motor-generator equipment which generates current for the electro-deposition of 239 troy pounds of silver in the space of ten hours on musical instruments or the equivalent of 450 troy pounds of gold in ten hours.

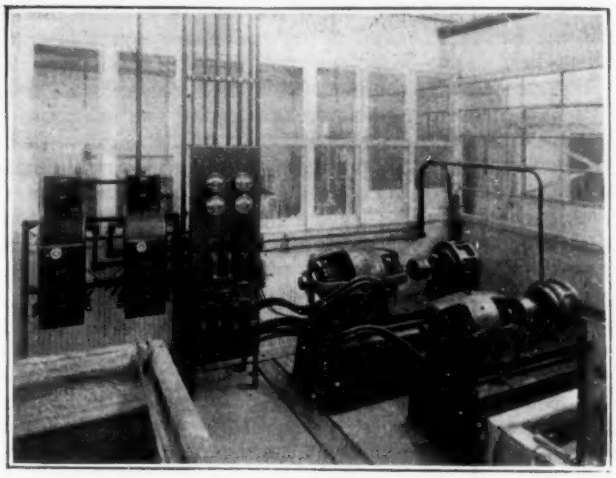

FIG. 5—MOTOR-GENERATOR EQUIPMENT

Glue for Brass

Q.—I would like you to advise me of a glue mixture, or several glue mixtures which can be used to glue paper to rough brass and bronze castings; also to copper castings. We often have occasion to ship castings loose, and previous to this writing, we have been marking the castings with a brush, using as an ink, a mixture of lamp black, alcohol, and shellac. However, I wish to have the address of the consignee written on the typewriter on ordinary paper, and the paper glued to the casting. If it is necessary to use a special grade of paper, also kindly advise.

A.—Sodium silicate, commonly termed Water Glass, or Mineral Glue, is used extensively as a glue in the manufacture of heavy cardboard boxes, etc. It is especially valuable for securing cloth or paper to metal.

Yellow dextrine, the material used on postage stamps, can also be used, or any good fish glue. Any good ordinary paper can be used.—C. H. PROCTOR.

Brazing Cast Iron

Cast iron can be successfully brazed so long as ordinary care is exercised in the operation. In order to obtain the best results the cast iron in the vicinity of the weld should be heated gradually to a dull red in order to clean the pores of the metal from grease or foreign substances. The surfaces should then be brushed well with a stiff wire brush and any loose fibres removed. The pieces should be arranged to join up to each other in the way they will be when brazed and wire or clamps used to insure that they cannot move during the brazing process.

A brazing mixture that has proved most successful on cast iron is made of 1 lb. boric acid; ¼ lb. pulverized chloride of potash; ¼ lb. carbonate of iron. The ingredients are mixed together in their dry state and kept in tightly corked bottle. When required for use the metal is heated to a bright yellow color and the flux applied mixed with grain spelter in the locality of the braze by means of a piece of rod flattened at the end into a small spoon.

The material should be allowed to cool very slowly. After brazing, under no circumstances should it be quenched in water.—P. W. BLAIR.

Tripoli Composition

Q.—I would like to have a formula for making Tripoli composition for buffing brass.

A.—Tripoli composition is prepared from tripoli, stearic acid and beef tallow. The proportions will have to be determined upon by experiment. Stearic acid is the hardener or binder, and tallow is the lubricant.

Paraffin wax is frequently used as an adulterant. Unfortunately there are no exact data available that we can furnish you. Commercial firms who manufacture polishing compositions have their own formulae.—C. H. PROCTOR.

Chromium Plating on Printing Plates

The Process Used by the U. S. Bureau of Engraving and Printing for the Reproduction of Engraved Plates. From the Monthly Review, October, 1925*

By H. E. HARING

Associate Chemist, Bureau of Standards, Washington, D. C.

INTRODUCTION[1]

Several years ago the Bureau of Standards, in co-operation with the Bureau of Engraving and Printing developed an electrolytic process for the reproduction of engraved or "intaglio" plates, such as are used for printing currency and securities. The plates produced by this process, which has been in successful use since that time, have a nickel printing surface, backed up by successive layers of copper and nickel.

In plate printing the metal surface is rubber with coarse cloth before each impression to remove the ink from the plane surface and to leave ink only in the engraved lines. This process involves severe abrasion, and hence the nickel plates do not last as long as the case-hardened steel plates, which had been formerly used exclusively. In order to increase the hardness of the surface of the electrolytic plates, the application of chromium plating was considered, because chromium is the hardest metal known.

A process was developed by which about 0.0002" of chromium is deposited upon the nickel surface of an otherwise finished electrolytic plate. The results with about 1,000 such plates show that the impressions are even better than from the originals, and that they will yield several times as many impressions as the nickel-faced or the case-hardened steel plates. It is also possible to deposit the chromium on steel plates which have not been case-hardened and to secure from them greater service than from case-hardened plates. It is too early to estimate the average probable life of the chromium-faced plates, but from present indications their use will utimately result in an annual saving of thousands of dollars to the Bureau of Engraving and Printing.

These results indicate the possible value of chromium plating for other purposes, especially where extreme hardness is required. In some cases it may replace the more troublesome and more expensive case-hardening process. Other properties of chromium plating which may prove useful are its high lustre and reflecting power and its resistance to tarnish and oxidation, and also toward certain chemical reagents.

The investigation of chromium plating at the Bureau of Standards is still in progress. This paper will therefore be confined to certain general principles, and to the actual method used on printing plates. Some modification of these conditions may be required for other specific purposes.

GENERAL PRINCIPLES

Almost all the solutions for chromium plating suggested in recent years have as their principal constituent chromic acid, CrO_3, together with a small amount of chromium sulphate, $Cr_2(SO_4)_3$, either added as such, or formed in the solution by some means. Experience with solutions containing only these two substances indicates that erratic results are often obtained. The study conducted at the Bureau has led to the conclusion that in order to produce satisfactory deposits of chromium it is necessary to maintain the degree of acidity or hydrogen ion concentration within definite limits. It has not been found possible by existing methods to measure the acidity (pH) of these strong solutions of chromic acid. It is possible, however, to regulate the acidity and keep it within the desired limits by having present in suspension some substance which will be readily formed or dissolved if the acidity changes, i. e., will exert a buffer action.

Such a substance is "chromium chromate," a compound of chromic acid and chromium in the next lower state of oxidation. The chromium chromate may be added as such to the bath, or may be formed in the bath by the addition of any suitable basic or reducing substance, or by the use of chromium anodes, or of lead anodes under proper conditions. It is almost certain that every chromic acid bath thus far proposed contained some of this suspended colloidal chromium chromate when satisfactory deposits were produced, even though no steps had been taken to form it intentionally.

In the actual process at the Bureau of Engraving and Printing, chromium carbonate is added to the solution. This dissolves with effervescence, and forms chromium chromate, the presence of which is indicated by a nearly opaque reddish brown color in place of the ordinary deep orange of chromic acid.

With a given solution and acidity the cathode efficiency and the character of the deposit depend upon the temperature and current density. Three distinct types of chromium deposit may be produced. At a given current density, by increasing the temperature, we obtain (1) a dull, frosty or "burnt" deposit, which may range in color from nearly black to light gray; (2) a brilliant, smooth deposit of as high a lustre as the base metal, even after hours of deposition, and (3) a smooth, but scant deposit, with a bluish, milky appearance. If the temperature is fixed and the current density increased, we obtain in order, the milky, the bright and the burnt deposit.

In Fig. 1, the curves show the relation between cathode efficiency and temperature for several current densities, and the dotted lines indicate the regions within which the three types of deposit are produced. Curve A is for 50 amp./sq. ft., B is 100 amp./sq. ft., and C is 200 amp./sq. ft., on most metals including nickel-plated surfaces. Region 1 gives burnt deposits; 2, bright deposits, and 3, scant deposits. It was found, however, that in order to deposit satisfactorily on the nickel face of an electrolytic plate, i. e., upon the layer of nickel first deposited in the previous electroforming process, it requires a higher current density than on other surfaces, e. g., 200 amp./sq. ft., instead of 100 amp./sq. ft. It is probable that this difference is due to the effect of the very fine structure of the initial nickel layer. Curve B represents the conditions with 200 amp./sq. ft. upon such a nickel face, and

*Published by permission of the Director, Bureau of Standards, Department of Commerce, Washington, D. C.

[1] The essential facts regarding this process were presented at the meeting of the American Electroplaters' Society on June 30, 1925.

also 100 amperes per sq. ft. on other metal surfaces. From the curves in Fig. 1, it is evident that the metal cathode efficiency is always low, and changes greatly with current density, as does also the character of the deposit. In consequence it is difficult to plate chromium on irregularly-shaped articles. In the recessed parts there is likely to be little or no deposit, while on exposed parts the deposit may be gray or burnt. The extreme hardness of chromium makes it difficult to produce, by buffing or polishing, a high lustre on a dull chromium surface. Extensive application of chromium plating will therefore depend upon a marked improvement in throwing power.

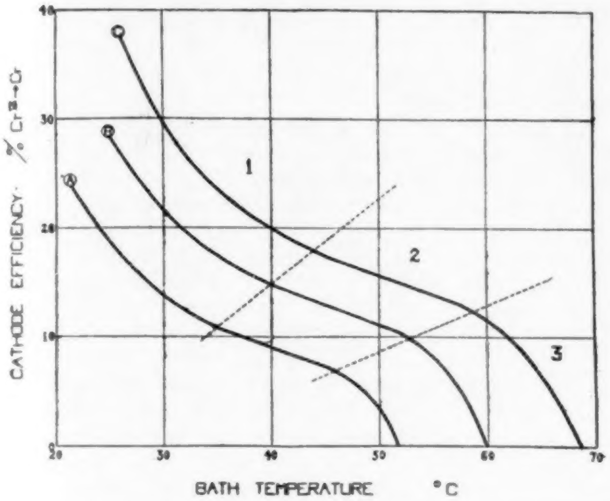

FIG. 1. TYPICAL "OPERATING CURVES" FOR CHROMIUM DEPOSITION

Curve	Current Density
A	50 amp./sq. ft. (5.5 amp./dm^2)
B	100 amp./sq. ft. (11 amp./dm^2)
C	200 amp./sq. ft. (22 amp./dm^2)

Type of deposit:
1 "Burnt" deposit
2 "Bright" deposit
3 Scant, bluish deposit

[1] Note—On electrolytic nickel printing plates, curve B represents 200 amp./sq. ft. (22 amp./dm^2).

In plating chromium, especially upon iron or nickel, it is necessary to have the current on the cathode when it is introduced into the bath. If this is not done, the surface becomes "passive," and those parts which would normally receive a low current density will receive no deposit. Hence the apparent throwing power will be even worse than under the favorable conditions.

It is possible to strip chromium from steel or nickel by a reverse current in chromic acid, which does not attack these metals. To remove chromium from copper or brass it may be made the anode in dilute hydrochloric acid, or may be treated directly without a current with (1—3) hydrochloric acid.

Operating Conditions

The solution used at the Bureau of Engraving and Printing is prepared from:

	g/L	oz/gal
Chromic acid CrO_3	250	33
Chrominum sulphate $Cr_2(SO_4)_3$	3	0.4
Chromium carbonate $Cr_2O(CO_3)_2$	7	1.0

The exact concentrations are not, however, important. The composition may be controlled by chemical analysis, in which the chromium present in the three forms is indirectly determined.

The solution is contained in a stoneware jar, which is immersed in water in a larger tank. The anodes consist of sections of lead pipe with a total area equal to about one-half that of the cathode surface to be plated, and so placed as to produce a nearly uniform current density on the cathode. Behind the latter (which is plated on only one side), a coil of lead pipe is suspended, through which hot or cold water can be circulated to regulate the bath temperature. Very good ventilation is required, as a large amount of spray is formed, which is injurious to the nasal septum.

The plates are cleaned as cathodes in an alkaline cleaner, scrubbed with pumice, rinsed in warm water, rapidly dried, and placed in the bath in such a way as to complete the circuit. Drying is advantageous, but not absolutely necessary.

The bath is kept between 104 and 122°F (40° and 50°C), and preferably at 113° F (45°C). On steel plates the current density is 100 amp./sq. ft. (11 amp./dm^2), which requires about 7 volts, and on electrolytic plates, 200 amp./sq. ft. (22 amp./dm^2) using 9 volts. In both cases the metal cathode efficiency is about 12 per cent. In order to deposit about 0.0002" (0.005 mm) of chromium, the steel is plated for sixty minutes and the electrolytic nickel for thirty minutes.

Pencil Ferrule Finish

Q.—I am in search of information regarding pencil ferrule finishes. My present finish is satisfactory. It is entirely mechanical; cut down and polished in barrels, color dipped and barrel burnished. The color desired is 14K. gold. My trouble is holding the finish. My method of lacquering is dip. I use eyelet brass.

A.—1. If you want a color equal to 14K. gold, then eyelet brass will not finish up to this color. Use gilding or platers' metal, an alloy of 90 per cent copper, 10 per cent zinc. This metal is used by the manufacturers of cheap jewelry that depends chiefly upon the finish.

2. After fabrication, cleanse free from grease, etc., by regular cleaners. Wash in water and acid bright dip in the following solution:

Nitric acid 38°	2 gallons
Sulphuric acid 66°	1 gallon
Water	1 pint
Muriatic acid	2 ozs.

Mix the acids in the order given; use when cold and keep the acid container surrounded by running cold water. Use an aluminum dipping basket for acid dipping; a steel wire basket for alkaline cleaning.

3. After dipping then wash thoroughly and ball burnish the ferrules. Use plenty of steel balls, and as a lubricant, soap bark about ½ to ¾ oz. per gallon of water. Tumble until bright with ample lustre, then wash in cold water and immerse in boiling hot water to which is added a small amount of borax soap or soap chips; ¼ oz. per gallon of water will be ample.

4. From the hot soap solution dry out by the aid of maplewood sawdust. The ferrules so treated will give you the results you desire and will not require lacquering.

5. If after ball burnishing and drying out, the ferrules do not have the high lustre you want, then procure some sole leather chips in sufficient quantity for tumbling purposes. To the leather chips add some Vienna lime powder so that the leather becomes coated over, then put in the ferrules and run at 100 revolutions per minute. A buffing action will result.

6. In case it is necessary to lacquer the ferrules then arrange to tumble them and spray the lacquer on while they are tumbling. Afterwards dry out upon wire mesh frames at 200° F.—C. H. Proctor.

Chemical Analysis and the Electro-Plater

The Value of Chemical Analysis and Its Limitations in the Plating Plant. Other Measures Necessary for Scientific Control. Conclusion*

Written for the Metal Industry By JOSEPH HAAS and ELMER R. UNRUH

REGULATION OF ELECTRICAL CONDITIONS

By regulation of electrical conditions:

(1.) Plating solutions can be operated so as to reduce labor costs. We can determine the maximum current density that can be used without impairing the quality or the texture of the deposit. After the maximum current density has been determined we can use this value as a standard operating condition and can therefore operate at a higher current density than previously, thus shortening the time the work remains in the solution, thus obtaining increased production and lower labor cost.

Under standard electrical conditions the effect of increased temperature in the operation of plating solutions will be taken into consideration. With an increase in temperature a higher current density can be used, which as we have previously shown will increase production and reduce costs. The following results obtained from observations on the operation of a nickel solution used for plating on steel will show the value of temperature regulation. These results were obtained from the normal operation of the solution, that is, no effort was made to control the temperature although its effect was taken into consideration.

E. M. F.	Amps	Temperature °F	Cathode current density Amps/sq. ft	Time in minutes
3.1	38.0	64	8.08	30
3.1	40.0	78	8.51	28
3.2	42.0	64	8.93	27
3.2	46.0	77	9.80	24
3.4	42.0	65	8.93	27
3.4	52.0	76	11.06	21

In the commercial operation of plating solutions it is well to have tables or charts posted near the operators showing the amperes to be used at different temperatures. The following is an illustration of a table or chart for this purpose:

TEMPERATURE (STANDARD)—AMPERES

Solution No.	50°	55°	60°	65°	70°	75°	80°	85°
1								
2								
3								
4								

Unless the plating equipment includes the use of Sangamo meters which record the amount of metal deposited and automatically signal when the specified amount of metal has been deposited, where it is necessary to produce uniform deposits, it is necessary to have another set of tables or charts to use in conjunction with the Temperature-Amperes table. It is evident that as we increase the current the time of deposition must decrease, and this fact is included in tables similar to the following:

AMPERES—TIME STANDARD

Solution No.	30	35	40	45	50
1	1.10 hr.				
2					
3					

* Part 1 was published in our issue of January, 1926.

(2.) Plating solutions can be operated so as to decrease bad work. Very often much bad work is caused by a lack of regulation of the electrical conditions. Apparently we are operating our solutions under normal conditions, but one of the electrical conditions, temperature, is changing from day to day. Maybe the change is not enough to be noticeable daily, but ultimately it will be noticed in bad work.

An example of this is the behavior of silver striking solutions used in plating on steel. The composition of these solutions was maintained constant and constant voltage was used. The results were very good during the Fall, Winter and Spring; rejects were very low. During the warmer part of the summer much trouble was experienced with blisters at the top of the cathode. These blisters were found to be gas blisters caused by too vigorous evolution of gas, which in turn was caused by too high current density. The cause of the higher current density was the increase in temperature. We had maintained the composition of the solution and the voltage constant, but increased temperature had increased the current density until it was excessive. The trouble was eliminated temporarily by reducing the current density and permanently by regulating the electrical conditions.

Another illustration of regulation of electrical conditions decreasing the amount of bad work is in the operation of nickel solutions. If the same current density is maintained in the Winter as produced good deposits in the Summer, it will be found that the nickel deposit, although it appears to be perfect will flake and chip off when struck or bent. This is caused by the decrease in conductivity of the solution due to the lower temperature, and to produce satisfactory deposits, either the temperature must be raised or the current density lowered, which is just another way of saying that the electrical conditions must be regulated.

(3.) To determine inefficient composition of solution, and in that way to modify it to take a higher current density. We can determine, by regulating and observing electrical conditions, whether a solution is performing as it should, knowing from past experience and observations the approximate current density and voltage that can be used at ordinary temperatures. If the solution does not perform as it should it is quite evident that the solution is of inefficient composition.

The writer has had some experience with silver plating solutions that illustrates this point very well. In working with some silver solutions that had been in use for some time and the composition of which was entirely unknown, it was observed that the maximum current for the class of work being plated was 40 amperes which corresponded to a current density of 4 amperes per square foot. This was not as high a value as it should be possible to use with a standard silver plating solution. But as work would burn at a higher current density, it was thought that the composition of the solution was not such as to produce efficient operating conditions. On making subsequent chemical analyses and additions of chemicals to the solutions, and by regulating electrical conditions a current of 80 amperes was used, which corresponds to a current density of 8 amperes per square foot, thus shortening the time of plating by one-half.

RECORDS OF PERFORMANCES AND RESULTS

Little benefit will be derived from haphazard analyses and regulation of electrical conditions. To be of real value chemical analyses and regulation of electrical conditions must be performed at regular intervals and must be systematic. Conditions of plant operation will determine whether chemical analyses and regulation of electrical conditions should be performed at regular intervals of time or after definite amounts of work have passed through the solution. If the plating solutions are used regularly every day it would be best to have the analysis made once or twice a week as the occasion may demand. But if the plating solutions are only used intermittently, and sometimes remain idle over short periods of time, it would be better to have analysis made after a quantity of work has passed through the solution the plating of which requires a definite interval in the operation of the solution.

The derive any value from a regular systematic chemical analysis and regulation of electric conditions it is necessary to observe all other operating conditions, such as condition of anodes; condition of solution as regards clearness and freedom from suspended dirt and particles; amount and condition of gas evolution, that is whether gas is evolved at the cathode slowly or rapidly. It is also necessary to observe the character of the deposit produced, especially as regards color and texture. Often it is necessary to subject the deposit to porosity and corrosion tests.

All these tests and observations would be of little value if they were made and the results forgotten after a few days had elapsed. To be of value it is necessary that all results of systematic analyses, regulation of electrical conditions, observations on the operation of the solution, and observations and tests on the character of the deposit be recorded on such a form and in such a manner that they are immediately available and instant comparisons can be mde of different solutions, or of the same solution over different periods of time.

In the case of solutions to which additions are made weekly it would be advisable to make a chemical analysis near the end of the week, along with an observation of the voltage, current density, temperature, general condition of the solution and work plated in the solution. These results would be recorded on a suitable form along with a record of the amount of chemicals added to the solution at the end of the week.

Convenient forms, which are self explanatory and which would contain all the required information for instant comparisons are illustrated.

EXPERIMENTING WITH CERTAIN TYPES OF SOLUTIONS UNDER VARYING CONDITIONS

Frequently it is necessary to conduct experiments in the plating room. This may be brought about by defects in the operation of a solution, the remedy for which cannot be determined by mere observation. Or the plater may learn of some new wrinkle from the current literature on the subject of plating that may improve the quality or texture of the deposit, or improve the efficiency of the solution which would lower plating costs, or improve the system of operation so that operations are easier to perform and less likely to cause trouble in the form of bad or spoiled work.

It is necessary to experiment to determine whether the improvement suggested is practical in regular commercial work. Even if lengthy laboratory experiments have shown that the improvement is warranted it is not advisable to change commercial operations at once but rather to conduct experiments on a semi-commercial scale to justify conclusions drawn from laboratory experiments.

In experimental work it is advisable to use small volumes of solutions. When it is desired to study different types of baths and to determine the effect of various concentrations and additions it is best to conduct preliminary experiments on a very small scale, one quart to one gallon, and to confirm all conclusions reached in small scale experiments, by a few experiments on a semi-commercial scale, that is, using from ten to twenty-five gallons.

As it is usually the object of experimental work in electro-plating to compare different solutions and types of solutions, reliable results can be obtained by coupling the solutions in the electric circuit in series, as under this arrangements if we have the anode and cathode areas equal the current densities will be equal as the same current flows through both solutions. However if it is necessary to connect the solutions in parallel it must be remembered if resistances or polarization differ the current densities will vary.

The most important fact to bear in mind in experimental work is that we must have only one variable. That is, we must change one condition, and only one condition at a time if we desire to formulate definite conclusions after all experimenting has been accomplished.

It is well to have some tentative plan of experiments formulated beforehand. In this plan could be included the variables that might influence results, and the order in which they would perhaps influence results. In this manner the time and number of experiments may be reduced. The time and number of experiments may also be reduced by changing the variable within wide limits at first to determine any marked differences in results.

It is important to keep a close record of all experiments even if results are unfavorable and the experimenter has failed to accomplish the purpose of the experiment. All information should be included in the records so that they will not only be valuable in drawing conclusions at the termination of the tests, but in making comparisons at some future time.

In drawing conclusions from experiments the fact must be borne in mind that we cannat always reproduce, in a small volume of solution, the same conditions that are present in a large commercial solution. Such conditions

FORM FOR SILVER SOLUTION

SILVER SOLUTION No. —

Gallons of solution: Cathode surface:
Anode surface: Distance between electrodes:

	Analysis			Current Conditions			
Date	Ag	NaCN	Na_2CO_3	Voltage	Current Density	Temp. °F.	Observations and Additions
......	....	....	......	......	......	......	....
......	....	....	......	......	......	......	....
......	....	....	......	......	......	......	....
......	....	....	......	......	......	......	....
......	....	....	......	......	......	......	....
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......	....	....	......	......	......	......	....
......	....	....	......	......	......	......	....
......	....	....	......	......	......	......	....
......	....	....	......	......	......	......	....
......	....	....	......	......	......	......	....

Remarks and Operating Conditions.

FORM FOR NICKEL SOLUTION

NICKEL SOLUTION No.

	Analysis				Current Conditions			
Date	Ni	Cl	pH	Other Substances	Voltage	Current Density	Temp. °F.	Observations and Additions
......	....	....	....	......	......	......	......	....
......	....	....	....	......	......	......	......	....
......	....	....	....	......	......	......	......	....
......	....	....	....	......	......	......	......	....
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......	....	....	....	......	......	......	......	....
......	....	....	....	......	......	......	......	....

Remarks and Operating Conditions.

as distance between anode and cathode, or ratio of anode area to cathode area may vary enough to change results.

However if we can produce the same conditions in our commercial solutions that were obtained in the experimental solutions we can expect the same results.

THE PROPER INTERPRETATION AND USE OF CHEMICAL ANALYSIS, ELECTRICAL REGULATION, RECORDS AND EXPERIMENTS

The records, containing results of all chemical analyses, electrical conditions, results, performances and observations together with experimental work will be of little value unless used. These records can be used advantageously in eliminating and avoiding trouble. They will show if additions have been made properly to keep the composition of the solution within the limits of good working conditions. Records will show if undesirable substances are approaching the concentration where they will cause trouble. Records will show if the regulation of electrical conditions have been made to take into consideration the influence of temperature. The records will help to eliminate trouble by showing conditions under which past good performances were accomplished. If we can produce the same conditions after trouble has been experienced we may be able to eliminate trouble immediately, but even if we can not eliminate trouble by producing good operating conditions, we have established a good basis to work from. By frequent reference to the records and by comparison with past performances we can, in a large measure, avoid trouble, for if we know the conditions for good operation we can maintain them. Conditions will not change sharply, so by frequent reference and study of the records we can estimate when conditions are changing and how to bring them back.

We have dealt quite lengthily with the scientific control of the plating room, yet it does not mean that a plating room operated in this fashion makes the plater's job sweet and easy. He still has his troubles—less than before—but they are there. We can repeat the axiom with confidence that uniform conditions give constant uniform results. But it is because of the practical difficulty of controlling those conditions in production, and because there is still much to be learned, that results are not always what they should be, or troubles completely eliminated.

Review of the Silver Market for 1925

An Abstract of the Annual Booklet Published by Handy & Harman

The year 1925 has shown continued progress along lines of financial and economic stability. China and India have been large buyers, and it is not surprising that the average price of silver expressed in cents was higher during 1925 than for any year since 1920. The average is of importance, because both in New York and abroad peak quotations during other years exceeded the 1925 high figure; and the price in cents rather than in pence is mentioned as indicative of the value because the higher London rates in recent years have been due solely to depreciation in sterling exchange.

PRODUCTION

Based on information now available we estimate the world production of silver for 1925 at two hundred and thirty-eight million ounces, a falling off of only one million ounces from the 1924 output as given in the latest report of the Director of the Mint. Of this total we attribute sixty-four million ounces to the United States, nineteen million ounces to Canada and ninety-one million ounces to Mexico. Our estimate of the amount produced by other countries is sixty-four million ounces, the increase being due chiefly to a large output from Peru.

AMERICAN COINAGE

We estimate that the U. S. Bureau of the Mint has purchased seventeen million ounces for subsidiary coinage, and that the Mexican Government has bought three million two hundred and eighty-seven thousand ounces to replenish their silver currency.

INDUSTRIAL DEMAND

The arts and industries in the United States used more silver during 1925 than ever before. The consumption, according to our estimate, was 31,000,000 ounces, or 11% more than 1924, and 6% more than 1923, which was the best year heretofore.

Manufacturers of sterling silverware and silver plated-ware report that the volume of business in 1925 was most satisfactory, and that the holiday trade was especially good. The outlook for the early months of 1926 is very favorable, as the demand for merchandise to replenish depleted stocks is likely to be brisk.

The chemical and photographic industries also had a successful year. We estimate that the silver used for these purposes reached a total of 7,000,000 ounces.

Advices from England report a consumption in the arts of 5,000,000 ounces for 1925, compared with 4,500,000 ounces and 4,000,000 ounces respectively for the two preceding years.

India's huge consumption continued during 1925.

China has also lent valuable support to the silver market through purchases for the year which totaled about fifty-nine million ounces, according to the latest available export data from this country, London and Canada.

OUTLOOK FOR 1926

For the immediate future there is the possibility of some improvement in price towards the latter part of January and during February, due to the Indian wedding season and purchases of bullion against exports on the part of China. Beyond this time the market level of the white metal will be determined chiefly by the demand from these two great silver using countries.

An accurate forecast of the coinage situation is impossible, but in our opinion it is unlikely that there will be sufficient support from European or other countries to affect the market appreciably. Variations in the amounts consumed in the arts or for commercial purposes are also too small to have any pronounced influence.

A careful consideration of the various factors likely to affect the price of silver seems to justify the conclusion that current quotations are not high, and that the outlook for 1926 is favorable.

Correction

In the article on the Uses for Centrifugal Casting Calculations by Robert F. Wood in THE METAL INDUSTRY for December, 1925, a typographical error occurred which calls for correction.

On page 492, first column, last paragraph, the dimensions given should read 13 ft. long, 6 in. O.D., 5 in. I.D. at the upper end, and 3.5 in. I.D. at the lower end, the radii of the bore being 2.5 in. and 1.75 in. respectively.

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THE ALUMINUM WORLD, COPPER and BRASS, THE BRASS FOUNDER and FINISHER
THE ELECTRO-PLATERS' REVIEW

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EDITORIAL

Profits in Fabricating Copper

The leading article in this issue is a report of a talk by Arthur Notman, a consulting mining engineer of New York City, comparing the profits in fabricating copper and copper base alloys with the profits in mining and refining copper. Mr. Notman has made a most interesting analysis in a field known for the difficulties which it raises to investigators. Admittedly, his figures are not complete for the entire industry; we doubt if anyone could obtain really complete statistics. However, his deductions are of such a nature as to challenge the attention of everyone interested in primary copper and copper base alloys.

Briefly stated, Mr. Notman's conclusions are as follows:

1. The Anaconda Copper Mining Company purchased the American Brass Company in order to assure itself of a permanent market for its metals and at the same time acquire a profitable business.
2. This purchase was eminently justified by subsequent results.
3. Other leading copper producers should adopt the same tactics and protect their output by purchasing consumers at a fair price.

From the companies analyzed it appears that the fabricators are engaged in a very profitable business, with comparatively small fluctuations. As a result their stocks have a market value of about twice the par figures. The fabricators are able to maintain the spread in prices between the raw material (electrolytic copper) and their finished products, such as sheet, wire, rod, etc. According to the table in the article, differentials on copper sheets beween 1912 and 1925 varied from 5¾ cents to 16 cents per pound. It is contended therefore, that the price of copper makes no difference to the fabricators who are always able to maintain their profit. Hence their business is always safe as it is not subject to competitive conditions existing in the copper producing industry. In short, copper producing calls for a very heavy capital outlay and is extremely risky, while copper fabrication calls for much less capital, is much more stable and proportionally much more profitable.

On certain points it is impossible to disagree with Mr. Notman. There is no question that the Anaconda Copper Mining Company acted wisely in acquiring the American Brass Company. The latter company has the peculiar combination of stability, profitable operation and steady growth, true only of companies large enough to be important factors in their field and at the same time very ably managed. Occupying, as it does, a position in the brass industry analagous to that of the United States Steel Corporation in the steel industry, and consuming enough copper to more than care for the Anaconda production, it was obviously the logical company to purchase. The price paid, about $45,000,000, has shown a yield which is decidedly fair; moreover it steadied the Anaconda company by removing it from the field of competitive copper sellers, except, of course, insofar as it is good business policy to allow the American Brass Company to pay for its metal at the correct current market rates.

That it would be advisable for other copper mining companies to follow the same procedure is much easier to advise than to carry out. In the first place, there is only one American Brass Company. Other companies in this business, while they may seem profitable to-day, and while they may be profitable over a long period, are certainly subject to sharper fluctuations than the leading factor. The other two great fabricators, the Chase Companies (concerning which no figures were obtainable) and the Scovill Manufacturing Company, are known to be extremely profitable, but not necessarily because of their direct fabricating business. Both of these companies do an immense amount of "cutting up" or manufacturing of finished articles which go directly to the jobber or even retailer. Their business covers everything from the first operation on wire bar to plated and finished novelties. It is well known that the percentage of profit rises as the product gets nearer to its ultimate consumer, as costs mount sharply in that direction. Hence these two companies have accumulated a considerable amount of more profitable business by going into the hundreds of different lines into which metal flows. Rumors have been afloat for several years that various copper companies have made advances to them, but the story goes that neither of these fabricators is anxious to be chained to a high cost producer with the possibility of crippling its power of purchasing metal at the best price.

Now, let us look at the other fabricators. Most of their products pass into three great industries, electrical products, building and automobiles. Those concerns catering to the electrical industries have a sound, steadily growing market with a comparatively narrow margin of profit, but essentially a good field in which to work because of its stability. However, a new danger has risen, namely the growing tendency of the users of wire and cable to manufacture their own: witness the Western Electric Company development in Hawthorne and Kearny. The fact that this business is not 100 per cent safe can be seen by remembering the plight of the Habirshaw Electric Cable Company and the National Conduit and Cable Company a few years ago.

It seems then that wire and electrical producers are subject to attack from above and below. The producers want to buy them and the consumers want to eliminate them. The moral is "Take Care."

The fabricators who sell to the building industry have been enjoying boom times for a number of years—but not boom prices. Any mill selling to the plumbing supply houses knows that business is placed largely on price basis and, as stated by J. J. Whitehead in our January issue, in his Review of the Wrought Metal Business, ". . . although most of the mills are well pleased with the situation from the order book viewpoint, it cannot be said that the same degree of satisfaction prevails as to the expectation of what the figures will show as to profits in the final balance sheet for the year." The important thing to remember is that the word "spread" is not synonymous with "net profits." Published prices (which, by the way, are not always the same as actual prices), may show a good margin, but costs may make this look very small by the time the material is shipped.

Those mills which cater to the motor industry have, to say the least, an exciting history. Automobiles ride on the top of the crest one year and wallow in the slough the next; and the same applies to any brass mills which depend upon them. The Detroit mills, we have been told have shown handsome profits. They have also shown heavy losses in bad times.

The brass business has appealed to many others before now. A long list of failures could be given, but one outstanding example will be enough—the West Virginia Metal Products Company, which started, full of hopes in 1919, the peak year, and after the expenditure of about

$3,000,000, found that business had slumped and there was no market for brass. After rolling about 4,000,000 pounds of metal the company went into bankruptcy and the property is on the market.

The sum and substance of the brass business can be stated very simply. It is a good business if it is capably managed and resources carefully conserved. Lines which are steady show comparatively small profits; the more profitable fields are subject to sharp and wide fluctuations. The copper companies casting sheep's eyes at this business will do well to move slowly and if possible, balance their interests to keep from being dependent upon any one industry.

In the meantime, if Mr. Notman's recommendations are to be taken up very rapidly, the brass business may find itself in danger of being swallowed by the interests which serve it, at the same time finding its business removed by the entry of its largest customers into the business of making their own fabricated products.

EXPANDING USES FOR METALS

More and more often in the past few years these times have been referred to as the Alloy Age. On all sides we see more and more vividly the increase, not only steady but in many cases startingly rapid, of the use of metals and alloys where once iron, steel, wood or other materials were used. A recent issue of the Bulletin of the Copper and Brass Research Association brings this vividly to mind by listing and illustrating some of the latest applications of copper and brass.

Toronto's new City Hall is now copper roofed; the Metropolitan Building in Toronto, said to be the largest and tallest office building (23 stories) in the British Empire, is brass piped for hot water throughout, with cornices and flashings of copper. Copper is going into electrical refrigeration units at the rate of 30,000,000 pounds per year. The new Madison Square Garden in New York has brass pipe ventilators. A list of public buildings with brass piping includes the following: Woolworth, New York; New York Telephone Company, New York; Biltmore Hotel, Los Angeles, Cal.; Shelton Hotel, New York; Hartford Fire Insurance Company, Hartford, Conn.; Penn-Harris Hotel, Harrisburg, Pa.; South Western Bell Telephone Company, St. Louis, Mo.; First National Bank, Boston, Mass.; Equitable Building, New York; Hotel Peabody, Memphis, Tenn.; Subway and Terminal, Los Angeles, Cal.; Spreckles, San Diego, Cal.; L. S. Plaut and Company, Newark, N. J. Add to this the tremendous increase in industries, old users of copper, like electric power transmission, and we see why the American consumption of copper has gone up by leaps and bounds in the past few years. As an example at Passamaguoddy Bay in Maine, a project is now under way to construct a modern, low head hydro-electric power station with capacity of from 500,000 to 700,000 H.P., using the head made available by the rise and fall of the tides which vary from 18 to 27 feet. Copper will be used in this installation for generator windings and parts, bus-bars, transformers, substation equipment and transmission lines to a total of about 25,000,000 pounds.

Aluminum has made great strides, one of the most spectacular being in the aircraft industry. All-metal planes are spreading rapidly and airships of the Zeppelin type now use aluminum alloys as the standard for their frame work. In addition, its use in the paint industry is being watched with interest and it has shown itself a factor to be considered very seriously in electrical transmission lines.

Nickel, has made one of the most remarkable gains of any metal in the last five years. After the disarmament conference, it was left without its most important outlet, nickel steel for armor plate, but since then has developed a large number of important markets for both pure nickel and alloys, such as Monel metal and nickel silver. The chemical industries, hotels, laundries, washing machines, ice cream manufacture, food products and restaurants have been responsible for most of this growth.

Lead has found few new uses, but its standard outlets have grown, keeping up a steady demand for the metal. The same applies to tin and zinc. The last named, however, is being pushed by its adherents to make better and more satisfactory products, such as zinc coated sheets, so that its progress is likely to make a real impression in industry in the near future.

Figures are not available to show whether iron and steel have fallen off in their consumption in proportion to the total of metal products used, but we are inclined to doubt this. The chances are that metals, on account of their permanency and their ease of manufacture, are moving into fields formerly occupied by non-metallic materials. A shining example of this is the increasing use of metal for furniture, fence posts and telegraph poles instead of wood. Whether this is the final age of alloys is hard to say, but certainly the age of all metals, including iron and steel, and their alloys, has arrived with all the evidences of being here to remain.

ELECTRIC HEATING

For a number of years the brass industry has been actively confronted with the question of electric heat. The correct answer has resulted in tremendous savings to some; on the other hand, mistakes have resulted in heavy losses. The brass rolling mills have proved without a doubt that the electric furnace is eminently successful from every point of view, including production, ease of operation, working conditions and costs. Brass foundries have found the problem more difficult, as they are subject to conditions such as fluctuation of output, variations in mixtures used, etc., which the brass mills have to contend with on a much lesser scale. In some cases it has been very much worth while to install electric furnaces while in others it has been questionable.

In metal finishing, no general statements can be made as yet. Enameling and japanning can probably be done more conveniently by the use of electric heat, but after all the most important item is the financial one.

In this issue is a tabulation abstracted from one made up by the Power Committee of the National Electric Light Association, giving their recommendations as to the advisability of using electric heat in a number of industries. Those in these industries will do well to study this tabulation carefully before deciding what to do, and in addition to take into consideration their local conditions, particularly the item of local power costs and the service which can be given them by their local power companies.

Nor can it be stated that the decision once made is irrevocable. Conditions in the power industry are changing rapidly and will continue to change, making it necessary for manufacturers using heat processes to watch them closely in order to keep their methods of manufacture in the forefront.

GOVERNMENT PUBLICATIONS

Fluorspar and Cryolite in 1924. By H. W. Davis. Bureau of Mines, Washington, D. C. Price 5 cents.

Graphite in 1924. By Jefferson Middleton. Bureau of Mines, Washington, D. C. Price 5 cents.

Platinum and Allied Metals in 1924. By J. M. Hill, Bureau of Mines, Washington, D. C. Price 5 cents.

New Books

British Wire-Drawing and Wire-Working Machinery. By H. Dunell and Sir W. Peter Rylands. Published by Constable and Company, London. Size 7½ x 11, 185 pages. Price, payable in advance, $8.50. For sale by THE METAL INDUSTRY.

There is very little authentic material on wire working and every addition is welcome. The "Engineer," a British technical journal of note, has published a number of articles on the subject which have been collected to form this volume.

It is stated that the book is not intended to be theoretical or to give highly technical information in detail. Its subjects are chosen with the idea of taking those which involve the use of machinery and aim at the reduction of manual labor, rather than those which consist of either mathematical studies of detailed working "kinks." It is confined enitrely to British practice and published in the hope that information divulged may help toward a greater interchange of knowledge among manufacturers and consequent betterment of the trade. It is attractively and profusely illustrated.

The subjects covered are the following: The Manufacture of Wire Rods; Wire Drawing; Dies; Wire-Drawing Blocks; continuous Wire-Drawing Machines; Straightening and Cutting-Off Machines; Wire Factories; Wire-Netting Machinery; Wire-Weaving Looms; Electric Cable Making; High-Speed Stranding Machines; Barbed Wire Machines; Nail and Rivet Making Machines; Pin Making Machines; Needle Making; Safety-Pin Making; Wire Chain Making; Wire Flattening; Miscellaneous Machines.

Materials Testing. By Cowdrey and Adams. Published by John Wiley & Sons, Inc. Size 6 x 9, 129 pages. Price, payable in advance, $1.50. For sale by THE METAL INDUSTRY.

Here is a good concize manual for the testing engineer. It is a text to accompany a laboratory course in the state of materials under stress, and indicates the basic methods of attack and interpretation, placing within the reach of the reader, the principles upon which most specifications are based. The book was written from the authors' experience in the Massachusetts Institute of Technology, and will be found of great help in clarifying the bases of the various methods of testing now in use. Chapter headings are as follows. Province of the Testing Engineer; The Report; Testing Machines; Tensile Tests; Graphs; Compressive Tests; Torsional Tests; Transverse Tests; Dynamic Tests; Test Specimens and Holders; Fractures and Their Significance; Hardness Determination; Cement Testing; Testing of Sand; Timber Testing; Measuring Devices; Verification of Testing Machines.

Bureau of Standards. By G. A. Weber. Published by the Institute for Government Research. Size 6 x 9, 299 pages. Price, payable in advance, $2.00. For sale by THE METAL INDUSTRY.

The Institute for Government Research is an association for co-operating with the public officials in the scientific study of government. As part of this work, it has issuel a number of Service Monographs, of which this is Number 35. It covers the history, activities and organizations of the Bureau of Standards now part of the Department of Commerce.

Few realize the importance of the Bureau in our industrial life and only recently has any degree of publicity been given to its work. Originally its purpose was only the setting and recommendation of standard weights and measures but it has since grown to be one of the most important research organizations in the United States. It not only carries out this work of establishing standard weights and measures, but it does an immense amount of testing and research in electricity, safety, heat and power, fire resistive properties of building materials, automotive power, fuels and lubricants, optics, chemistry, sound, testing materials, metallurgy, ceramics, glass, etc.

A good sized chapter is devoted to the organization of the Bureau and explanation of the funds of the various divisions.

Financing a Business. By Joseph M. Regan. Size 5½ x 8, 362 pages. Price, payable in advance, $3.00. For sale by THE METAL INDUSTRY.

Financing a business is reviewed in these columns because the subject covered has such wide application and is of such importance to all industries including that of metals. The author describes methods of organizing and financing a new organization and also managing the finances of a going concern. He gives also simple plans and methods for interesting outside investors and selling stock, bonds, mortgages and other securities. The relations between the manufacturing concern and its bank are fully discussed.

Some of the chapter headings are as follows: Planning and Starting the New Business; How Much Capital Will You Need; Interesting Capital in Your Concern; Selling the Stock; The Use of Bonds in Financing; Meeting Additional Capital Needs in a Going Concern; Making the Right Choice of a Banker; Will Your Financial Statement Pass Muster; How to Borrow Profitably; How to Use the Trade Acceptance; Additional Sources of Funds; How to Curtail Borrowing; Making Finances Keep Pace with Business Growth; What to Do with Your Surplus.

Technical Papers

Gases in Metals, by Louis Jordan and James R. Eckman. Bureau of Standards Scientific Paper No. 514. Price 10c. Obtainable from the Superintendent of Documents, Washington, D. C.

This paper describes experiments on the determination of oxygen and hydrogen in metals by fusion in vacuum.

A train of solid absorbents was developed suitable for the direct determination of water vapor and carbin dioxide and for the indirect determination of carbon monoxide and hydrogen when these gases were passing through the train at low pressure. By means of this train one or all of these gases present in the mixture of gases evolved from a metal sample fused in vacuum may be accurately determined.

The high-frequency induction furnace was used for the fusion of the metal samples. This type of furnace permits the fusion of the samples in a small silica tube and holding the metal molten at temperatures of 1,500° C. or more while the walls of the tube remain comparatively cool. Thus, no difficulty is encountered from the failure of the tube to hold a vacuum.

Three methods of fusion previously employed in the determination of gases in metals fused in vacuum were applied to pure iron, a low-carbon steel; and a high-carbon steel. These methods were: (a) direct fusion of the metal in a refractory oxide crucible, (b) fusion in a refractory oxide crucible with the addition of antimony and tin, and (c) fusion in a gas-free graphite crucible. Neither (a) nor (b) is satisfactory for determining oxygen in ferrous alloys. Method (c) gives the most dependable values for total oxygen. The values obtained for hydrogen offer no choice between the three methods for the determination of this element.

Fusion of ferrous alloys in graphite determines, besides any oxygen present as such, the oxygen that may be present in the metal as CO, CO_2 and oxides of iron, silicon, manganese, aluminum, zirconium and titanium. The sulphur in the iron or steel sample does not interfere with the determination of oxygen.

The fusion in graphite method is also applicable to the determination of oxygen and hydrogen in many non-ferrous metals and alloys.

Report of Certain Molding Sand Resources of Iowa, Kentucky, New Jersey, Pennsylvania, and Wisconsin. Issued by the Joint Committee on Molding Sand Research of the American Foundrymen's Association. This report can be obtained from R. E. Kennedy, 909 W. California Street, Urbana, Ill.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

COPPER ON SILVERED PRISMS

Q.—I would like to have a formula for a copper plate for silvered prisms; something that will deposit quickly, in a few minutes if possible. The solution I am using at present is: 12 ozs. copper sulphate; 1½ ozs. sulphuric, and 2 ozs. bicarbonate of soda; but I have very poor results. What I want is a heavy deposit but quick, because if it takes very long to plate, it either tarnishes or my silver will leave the glass in strips.

A.—The following formula is used for backing-up silvered glass with copper: It is termed the non-acid or alkaline copper tartrate solution.

Water	1 gal.
Copper sulphate	24 ozs.
Rochelle salts	32 ozs.

It is advisable to use hot water to dissolve the copper sulphate, then add the Rochelle salts. When these materials are completely dissolved, then add aqua ammonia 26° in small amounts at a time until the solution becomes clear blue. Variations of this formula are used. Some firms find the following formula gives good results:

Water	1 gal.
Copper sulphate	7 ozs.
Rochelle salts	20 ozs.
Caustic soda	6 ozs.

Anodes, soft sheet copper. This type of solution should only be used to give a uniform adhering copper deposit to the silvered glass. The regular type of acid copper solution should then be used to produce heavy deposits. The following formula will give a heavy deposit:

Water	1 gal.
Copper sulphate	28 ozs.
Sulphuric acid	4 ozs.
Yellow dextrine	⅛ oz.

The voltage of this solution should not exceed 1 volt. Use an agitated solution. The Rochelle salt solution will require 2 volts or more.—C. H. P. Problem 3,483.

DARK STATUARY BRONZE

Q.—We have a large quantity of stamped brass shells to be finished dark statuary bronze. Is there an electroplate to give that finish? Our present method is copper lating and staining and rubbing down with sand by hand; this seems a slow and expensive method.

A.—To produce a dark statuary bronze finish upon brass shells, the procedure usually followed is given below:

1. The brass shells should be cut down to a uniform smooth finish with Tripoli composition.
2. Cleansed as usual for plating.
3. Copper plated for a few minutes in a hot copper cyanide solution, then washed thoroughly.
4. Oxidize in a solution of liver of sulphur, polysulphide or hydrosulphuret of ammonia, as follows: Water, 1 gallon; either of the above factors, ⅛ to ¼ oz.; ammonia, 26°, 1/64 oz. Temperature, 140° F.
5. As soon as the copper becomes very dark brown, remove, wash in cold and boiling waters, and dry out in sawdust.
6. Scratch-brush dry; use a soft brass or steel wire scratch-brush at 400 to 500 revolutions per minute. There are methods to produce the color direct upon brass, but they consume too much time.—C. H. P. Problem 3,484.

FINISHING ALUMINUM

Q.—We are submitting herewith sample of an aluminum frame and would appreciate your telling us just how the finish can be put on.

A.—Apparently the sample aluminum frame has been finished by the following manipulations:

1. The frame after fabrication, should be cleansed from grease, etc., by the aid of benzine, gasoline or heated kerosene, then dried in sawdust.
2. A matte or satin finish is produced upon the surface with a steel satin finish scratch-brush which can be purchased through platers' or foundry supply houses.
3. After brushing to produce the matte or satin finish, then cleanse in a regular alkaline cleaner (advertised in THE METAL INDUSTRY), using about 4 ozs per gallon of water, at 200 deg. F. Immerse the frames in the cleaner for a few moments until they become quite dark, then remove and wash in cold and hot waters.
4. Now immerse the frames in undiluted nitric acid 38° for a moment or two, then remove, wash in cold and hot waters, and dry out carefully with maplewood sawdust.
5. You can also try 2 parts nitric acid 38°, and 1 part sulphuric acid 66° under same conditions. Note which acid combination gives the whitest finish.
6. For cleansing the frame in alkaline cleaner, use steel wire or nichrome dipping baskets. For the acid dipping, use aluminum dipping baskets.—C. H. P. Problem 3,485.

FLASH GOLD

Q.—We are opening a plating department to finish our bronze with a cheap gold plated finish (I believe it is called Flash Gold). Could you give us any information regarding the solution used for this finish?

A.—We suggest that you get in touch with the supply houses advertising in THE METAL INDUSTRY regarding electro-plating equipment. They can furnish you with complete equipment and possibly with a man to do the work. The gold plating solution most satisfactory for your purpose is as follows: Water 1 gallon; sodium cyanide 96-98% 1 oz.; gold cyanide ½ oz.; bisulphite of soda ¼ oz.; caustic potash ⅛ oz. Temperature of solution 140-160° F. Voltage 3 to 4. Anodes 22 K. gold.

You can obtain a flash gold plate in less than one half minute with the above solution, if properly controlled with volt and ampere meters.—C. H. P. Problem 3,486.

GREEN GOLD

Q.—We have been referred to you as to securing a recipe that could be inserted in our green gold solution to have it non-tarnishable. At the present time we are having a little difficulty in our goods tarnishing while in stock.

We are also interested in an antique green gold finish.

A.—The factor you refer to as non-tarnishing is cadmium, which readily replaces silver either in the green gold karat alloys or the electro-plating solution.

Antique gold finish is produced by the aid of the green gold solution previously mentioned, by adding lead cyanide as may be required to give the antique black smut. The lead cyanide should be dissolved in as little hot water as possible with twice as much sodium cyanide. Add the lead cyanide on the following basis: Water 4 ozs., temp. 180° F.; sodium cyanide ½ oz.; lead cyanide ¼ oz. per gallon of solution; repeat the amounts as may be desired to produce the antique green gold finish. The black deposit or smut should be relieved from the high lights with bicarbonate of soda. It is always advisable first to deposit a coating of green gold from the regular solution, then deposit the antique green gold. The solutions mentioned should be operated at 80° to 100° F., at 3 to 5 volts.—C. H. P. Problem 3,487.

PLATING ALUMINUM

Q.—Our firm is going to sell aluminum bases, and they want me to plate them in all different colors, that is, copper, brass, etc., deposit, and I have tried a few different ways but cannot suit them. Could you help me in this matter?

A.—Aluminum as a rule is a difficult metal to plate successfully with copper, silver or gold directly. Nickel can be plated directly, however, if the aluminum is polished and cleansed as usual. Fol-

low up with an immersion in a passive dip, prepared as follows: Nitric acid 38° 2 gallons; sulphuric acid 66° 1 gallon; chloride of iron 3 ozs.; water 1 pint. Dissolve the iron in the water and stir thoroughly into the acids. Immerse the aluminum articles, cleansed previously in the dip, for a moment or two, then nickel plate in any good type of nickel solution. Use a fairly strong current first at 3 to 4 volts, then plate normally. For copper, brass or silver plating of aluminum, a deposit of zinc or cadmium upon its surface gives a satisfactory base deposit.

Zinc Solution:

Water 1 gallon; sodium cyanide 96-98% 6 ozs.; zinc cyanide 6 ozs.; caustic soda 73-76 2 ozs.; soda ash 58% 2 ozs.; aqua ammonia 26° 1 oz. Temperature 140° F., at 4 to 5 volts. Cleanse the aluminum as outlined, then zinc plate for two or three minutes; plate as desired. For gold deposits, brass plate the zinc plated surface first.

Cadmium Solution:

Water 1 gallon; sodium cyanide 96-98% 6 ozs.; cadmium oxide 3 ozs.; caustic potash 1 oz.; aqua ammonia 26° 1 oz. Anodes cadmium metal; temperature and voltage as outlined for zinc.—C. H. P. Problem 3,488.

PLATING GENERATOR

Q.—Would you kindly give me some information on the following:

1. Can I use a 6-volt, 500-amp. generator for still nickel, cyanide copper, brass and die castings; also, electro-cleaning?
2. Should iron tanks be asphalt lined for copper and brass?
3. Can I get the bound volumes of The Metal Industry for 1924-1925?
4. Kindly send me application for A. E. S., Chicago Branch preferred.

A.—1. A 6-volt, 500-amp. Meaker generator will be satisfactory for operating still nickel, cyanide copper and brass solutions, and for electro-cleaning. Die castings can also be plated with such a generator. The solutions, however, should not exceed 200 gallons each; the electro-cleaning will have to be done between plating operations. It will consume one-half the current available.

2. Iron tanks can be used without coating with an asphalt lining for cyanide solutions, except silver. It is, however, advisable to put a wooden lining on the side of the tanks, back of the anodes, and extending down below the anodes. This lining will prevent any possible polarization or reversal of the current between the back of the anode and the tank.

3. The bound volumes of The Metal Industry can be furnished, covering 1924-1925. Price, $3 each.

4. Write to Robert Meyers, 2210 Wilson Avenue, Chicago, Ill., secretary of Chicago Branch of American Electro-Platers' Society, for membership application blank.—C. H. P. Problem 3,489.

PURIFYING RED BRASS

Q.—We wish chemically to unite with our red brass valve metal, small steel chips, which accidentally get past our magnetic separator. We are using 15% phosphor copper for other reasons, but find that it does not seem to combine the iron with the brass. We have tried leaving out the phosphor copper.

Will manganese dioxide, when used in small quantities combined with the flux, cause the iron to change from free iron to combined iron?

Is potassium sulphate better than barium sulphate for causing impurities to rise to the surface of the metal?

Is there any way in which a red brass, containing tin 6%, lead 3%, zinc 6% and copper 85%, may be made stiffer without increasing the cost of the mixture and at the same time giving sound castings which are free turning?

A.—It is rather hard to get the steel chips in solution with your red brass mixture. The better way would be to use a flux to remove the impurities. High tin or high zinc alloy takes up the iron better than your alloy. There is no chemical we know of that will combine small amount of steel in a mixture such as yours. Even if it did combine, we doubt if it would be of any benefit, because dirty castings eat into the sand, are more or less porous and black. If you were using an open-flame furnace your iron would blow out. If you are using a crucible, we suggest you use a flux composed of: plaster paris, 1 part; soda ash, 1 part; common salt, 1 part; fine charcoal, 1 part. Use 3 lbs. per 100 lbs. of metal, with a small handful of lime.

The addition of manganese dioxide to your mixture would result in dirty metal unless the manganese content were extremely low, so low that the manganese would merely act as a deoxidizer; 4 ozs. of 30% manganese per 100 lbs. would be sufficient to deoxidize the metal and promote soundness. It will not increase hardness. It acts in small amount as a deoxidizer.

We consider potassium sulphate best for causing impurities to slag off, mixed with soda ash and sodium chloride to increase the stiffness in your alloy, without increasing the cost.—W. J. R. Problem 3,490.

RE-TINNING SMALL PARTS

Q.—Can you give us any information regarding the necessary equipment and formula used to re-tin small articles made of steel that are used principally in handling food?

We have made extensive inquiries to manufacturers of tinning equipment and find the only equipment offered is to take care of tinning sheets. This is not what we want.

A.—We can, if necessary, give you any specific details of the information you require covering hot tinning and re-tinning operations. However, regarding the general process, we would suggest that you purchase a copy of Flanders' Tinning and Galvanizing, latest edition. See Chapter XVI, page 121-128, of the 1922 edition.—C. H. P. Problem 3,491.

SODIUM PERBORATE IN NICKEL SOLUTION

Q.—At a meeting of the American Electroplating Society in Philadelphia, you spoke of a chemical to eliminate pitting and to make the nickel adhere more firmly to object being plated. I am very much interested in this chemical and would appreciate it if you would send advice about it.

A.—The factor mentioned at the educational session of the Philadelphia Branch of the American Electro-Platers' Society on November 21, for control of hydrogen pitting and to produce a more malleable nickel deposit is sodium perborate.

The material should be added to the nickel solution in proportions of 1/15 to 1/8 oz. per gallon depending upon the amount of hydrogen pitting in the nickel deposit or the nature of the brittleness of the nickel deposit. The minimum amount should always be used first, increasing to the maximum in small further additions. One pound of sodium perborate dissolved in 3 gallons of hot water, 120 deg. F., will be ample for 240 gallons of nickel solution based upon 1/15 oz. per gallon. The material should be stirred into solution until all dissolved. It requires a little time to go into solution. As soon as the solution becomes clear, then add pure muriatic acid to the sodium perborate solution; 8 ozs. fluid measure first, then test with blue litmus paper. The color of the litmus paper should equal the color of the paper when used in testing the acidity of your nickel solution. You will thus avoid an excess of acid in the sodium perborate solution which becomes converted to hydrogen peroxide by the addition of acid. It may require 16 ozs. of muriatic acid to produce the desired acidity. Make the additions slowly after the addition of the first 8 ozs. of acid. A few ounces of the sodium perborate solution should be added to the nickel solution about twice a week to prevent any further pitting. Try 8 ozs. per 100 gallons of solution twice a week as a basis.—C. H. P. Problem 3,492.

STRIPPING DIE CASTINGS

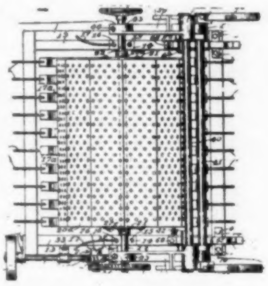
Q.—Kindly send us a formula to strip off nickel on die castings that will not affect the base metal in any way.

A.—Most die castings are an alloy of zinc, aluminum and copper with varying percentages. The zinc is always the greater in percentage. The usual acid strip consists of 4 parts sulphuric acid, 1 part nitric, with a very little water, which is suitable for stripping nickel from brass, copper or bronze, will be too radical for die castings. An electro strip will possibly be the best factor. Prepare a solution as follows: Sulphuric acid 66°, 9 parts; water, 1 part. To every gallon of acid and water, add 1 oz. glycerine. Use an acid crock or lead lined tank for the solution. The current should be just the reverse to plating, the work to be the positive and completely surrounded by sheet copper as the cathode. Use about 5 volts. The die castings should be removed immediately after the nickel has been removed.—C. H. P. Problem 3,493.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

1,563,041. November 24, 1925. **Electroplating Apparatus.** Forrest G. Purinton, Waterbury, Conn.

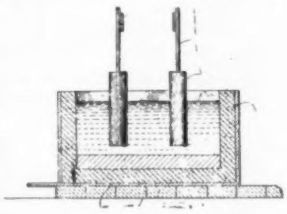


In an electroplating apparatus, a plating tank, a frame adapted to rock upon said tank, means to support said frame in equilibrium in separate plating, draining and dumping positions, a rotary plating barrel carried by said frame, a counterweight secured to said frame to counterbalance the weight of said barrel and contents, whereby said barrel will remain in perfect equilibrium in its plating, draining and dumping positions.

1,563,079. November 24, 1925. **Alloy.** Charles Alexandre Fontane, Paris, France, assignor to Emile Conti, Alfortville, France.

An alloy consisting of:—95 to 96 per cent aluminum, 4 to 3 per cent copper, 0.8 to 0.2 per cent manganese, 0.2 to 0.8 per cent silver.

1,563,187. November 24, 1925. **Process of Producing Calcium Copper Alloy.** William Goold Harvey, Niagara Falls, N. Y., assignor to American Magnesium Corporation, Niagara Falls, N. Y.



The process of producing calcium copper alloy comprising electrolyzing a molten calcium salt in the presence of a solid copper cathode until sufficient calcium has been taken up by the cathode for it to become molten at the temperature of the molten salt.

1,563,188. November 24, 1925. **Treating Molten Metals with Calcium-Copper Alloys.** William G. Harvey, Niagara Falls, N. Y., assignor to American Magnesium Corporation, Niagara Falls, N. Y.

The method of deoxidizing aluminum bronze comprising adding to the molten metal an alloy of calcium and copper in such proportions that the alloy is brittle and which has a melting point substantially less than that of the treated metal.

1,563,506. December 1, 1925. **Recovery and Utilization of Materials of Old Secondary Battery Plates.** Joseph O. Luthy, San Antonio, Tex., assignor to Luthy Research Laboratory, a corporation of Texts.

The method of utilizing old lead secondary battery plate material which comprises separating the material from the grids or supports, pulverizing the separated material, and mixing the pulverized materials from positive and negative plates in such proportions that the same combined with an aqueous binder will set up into a relatively hard and self-supporting cementitious mass. A lead battery plate comprising a grid and a filler composed of pulverulent recovered active material from old plates and an aqueous binding medium.

1,563,793. December 1, 1925. **Process for Applying Metallic Coatings to Porous Bases.** Kurt Ripper, Vienna, Austria, assignor to Fritz Pollak, Vienna, Austria.

A process for applying metallic coatings to non-metallic porous objects, which process consists of rendening the surfaces to be coated conductive by means of conductive substances in such a degree of dispersion, that the particles thereof are of smaller size than the pores of the base, and thereafter effecting the galvanization.

1,564,369. December 8, 1925. **Method of Casting Copper.** Leonard Shipley, Dundalk, Md., assignor to American Smelting and Refining Company, New York, N. Y.

The method of casting copper shapes which comprises pouring the molten copper into open molds and immediately covering the molds closely enough to prevent free contact of atmosphere while permitting escape of the occluded gases and during a time sufficient to prevent surface oxidization, rapid cooling and sudden degasification of the copper.

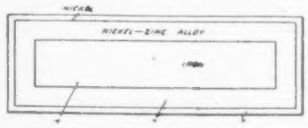
1,564,413. December 8, 1925. **Process of Electroplating Metallic Cadmium and Electrolytic Bath Therefor.** Clayton M. Hoff, Cleveland, Ohio, assignor to The Grasselli Chemical Company, Cleveland, Ohio.

Process of electrodepositing cadmium which comprises preparing an alkaline solution containing a compound of cadmium, a compound of ammonia and a cyanide and electrolyzing said solution.

1,564,414. December 8, 1925. **Cadmium Plating.** Clayton M. Hoff, Cleveland, Ohio, assignor to The Grasselli Chemical Company, Cleveland, Ohio.

A composition adapted for use in the electrodeposition of cadmium comprising a cadmium compound, a material which tends to prevent the co-plating of zinc with cadmium, an alkaline agent, a cyanide, and a material which tends to improve the quality of cadmium platings.

1,564,581. December 8, 1925. **Electroplating.** Willis R. King, Newark, N. J., assignor to The Hanson & Van Winkle Company, Newark, N. J.



The method of electro-plating on corrodible metals, which comprises applying first a coating of nickel-zinc alloy and then depositing upon the latter an outside coating of nickel.

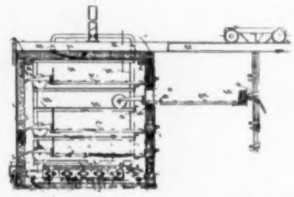
1,564,710. December 8, 1925. **Method of Coating with Metals and Resulting Products.** Arthur Z. Pedersen, West Orange, N. J., assignor, by mesne assignments, to Madsenell Corporation, New York, N. Y.

The method of preparing metallic surfaces to receive adherent metallic coatings which comprises making the object to be coated the anode in a bath containing sulphuric acid of more than about 75 per cent strength.

1,564,786. December 8, 1925. **Composition for Cleaning and Polishing Silver.** Catherine M. Hemen, Seattle, Wash.

A cleansing and lacquer forming composition, consisting of four pounds of Spanish castile soap, one-half pound of oxalic acid, three-fourths pound of bicarbonate of soda, one quart of vegetable oil, nine gallons of water, and sufficient Paris white of extremely fine grade to substantially absorb the liquid content of the mass.

1,564,945. December 8, 1925. **Electric Core Oven.** Frederick A. Coleman, Cleveland, Ohio, assignor, by mesne assignments to Carl W. Schaefer, Cleveland, Ohio.



In an electrically heated core oven, an electric heating element, wall, ceiling and floor members formed of heat resisting material and a contiguous outer metal skeleton individually supporting each of said members.

1,565,068. December 8, 1925. **Drosser for Galvanizing Kettles.** Harry Clyde Ebright, Youngstown, Ohio.

The combination with an elongated kettle having its bottom extending horizontally for a certain distance and then upwardly inclined at its ends, of a scraper operating over said bottom and ends, motor operated means for shifting the scraper longitudinally in opposite directions, and guides for holding the scraper against the bottom, said guides comprising longitudinally extending guide strips attached to the walls of the kettle and extending parallel to the bottom and upwardly inclined at their ends, the strips being reinforced at the junction of the horizontal portion with the upwardly inclined portion.

1,565,115. December 8, 1925. **Solder.** James Buckner Speed, New York, and Arthur H. Falk, Brooklyn, N. Y., assignor to Western Electric Company, Incorporated, New York.

A solder consisting of substantially 11 per cent silver and 86 to 89 per cent tin.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

History of the Full Automatic Conveying Machine for Plating

The history of the development of the full automatic continuous chain conveyor for electroplating is interesting and is briefly outlined to show the trend of electroplating practice in the United States.

In 1906 Major David F. Broderick was delegated by the American Hardware Corporation to study, improve and standardize the various manufacturing processes of their several plants. A cost analysis indicated that excellent savings could be made in the plating and finishing departments provided the labor of handling builders hardware in the electroplating process through the intermediate dips could be eliminated and the electroplating treatment stabilized to produce uniform coatings and to reduce the volume of rejected work requiring reprocessing. These cost records also proved that the cost of electroplating was a considerable portion of the total cost of producing builders hardware and the cost of replating rejected work was several times the cost of complete finishing when no rejection is necessary. Furthermore it was then recognized that the plating department is the "neck in the bottle" of production and this "neck in the bottle" can best be removed by arranging the plating process for a continuous and uninterrupted flow of work.

As a result, Major Broderick designed an excellent continuous overhead full automatic chain conveyor upon which certain patents were granted, consisting of two roller bearing chains supported by a ceiling mounted framework, the roller chains carrying the work hangers on which the plating racks were hung. These work hangers were provided with roller studs arranged to engage lifting cams at the tank partitions so that, while the work was carried forward through the various solutions, at the end of each treatment the work hangers carrying the work were lifted out of the solution and automatically carried over the tank partition and immersed in the subsequent solution.

The principal claim of one of Major Broderick's patents very broadly and fundamentally covered this continuous overhead chain conveyor arranged automatically to carry work through the successive treatments of an electroplating cycle.

The American Hardware Corporation, of course, enjoyed shop rights under the Broderick Patents and they promptly installed a number of these full automatic conveyors in their various divisions, as for example, the Corbin Cabinet Lock Co., P. & F. Corbin Co., Corbin Screw Co., Russell & Erwin Co., and others. These original conveyors are still in successful operation and others of the same design have been built and installed by the American Hardware Corporation, as needed to care for their production. Some of these conveyors do brass plating, some do nickel plating, many of them were changed over during the World War to do zinc plating and later changed back for the different hardware finishes desired.

The Broderick Conveyor was not available to the public until

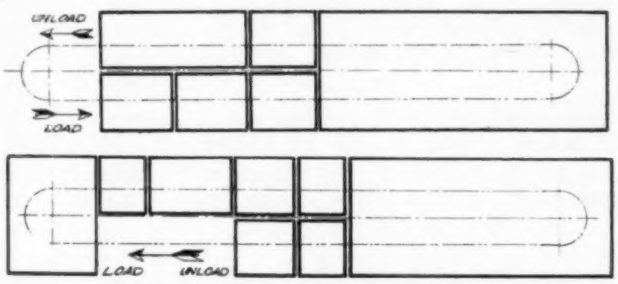


FIGURE 1—FLOOR PLAN OF A FULL AUTOMATIC CONVEYOR DESIGNED FOR END OR SIDE LOADING.

the year of 1916 when A. P. Munning & Company, Matawan, N. J., secured the exclusive right to manufacture and sell conveyors made under these patents. Such reputable manufacturing concerns as the Underwood Typewriter Company, Hartford, Conn.; the Hendee Manufacturing Company, Springfield, Mass.; the Walden-Worcester Wrench Company, Worcester, Mass., and the Columbia Graphophone Company, Bridgeport, Conn., realizing the many advantages of automatic conveyors for plating rooms, installed the Broderick Conveyor sold by the Munning Company.

The varied demand for automatic conveyors very naturally caused A. P. Munning & Company's engineers to study the Broderick Conveyor from every angle so that, if possible, a conveyor of more flexibility could be produced and particularly a transfer mechanism developed which would carry the work from one tank to the next faster than the linear speed of the work through the plating and other treatments, to reduce the time lost in transferring, and to prevent drying and tarnishing the work while passing from one solution to the next.

The result of that investigation was the development of the Munning Full Automatic Plating Conveyor which is described in their new bulletin No. 104, just off the press.

These improved full automatic conveyors have been installed for nickel, copper, brass, bronze, zinc and cadmium plating on various base metals and on such alloys as zinc-aluminum. Successive electroplating of different metal coatings and selective electro platings are problems satisfactorily handled by these conveyors in both small and large daily productions.

Such corporations as the Ford Motor Company, General Motors Corporation, General Electric Company, Landers, Frary & Clark Company, Winchester Repeating Arms Company, Stewart-Warner Company, Penn Hardware Company, A. Schrader's

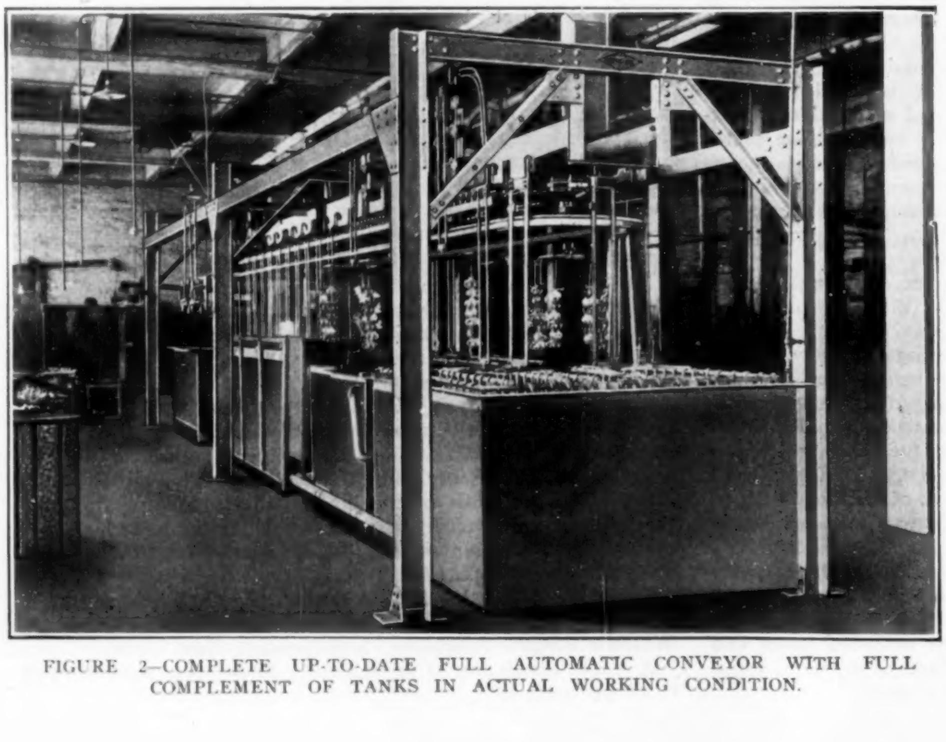


FIGURE 2—COMPLETE UP-TO-DATE FULL AUTOMATIC CONVEYOR WITH FULL COMPLEMENT OF TANKS IN ACTUAL WORKING CONDITION.

Sons Company, American Stove Company, Union Manufacturing Company, Off 'N' On Chain Company, H. Mueller Manufacturing Company, Brown-Lipe-Chapin Corporation, North East Electric Company, R. Neumann Hardware Company, the Singer Manufacturing Company, Bassick Manufacturing Company, Industro Manufacturing Company, Air Kool Spark Plug Corporation, Hyatt Roller Bearing Company, B. Mercil & Sons and Ontario Silver Company have installed one or more of these conveyors.

ROTH PEDESTAL TYPE POLISHING AND GRINDING LATHES

Roth pedestal type polishers and grinders, made by Roth Brothers & Company, Chicago, Ill., are designed specially for the work to be performed and so that workmen will be able to use these machines easily and efficiently, even when handling large or odd shaped pieces. The center line of the wheels is at the most convenient height, and the double shaft extension allows two men at the machine at one time.

By the special construction of the motor in this machine, as will be seen from the illustration, the motor is offset in the housing, bringing the shaft and the wheels forward. This gives an unusually large working surface around the wheel, and the face of the wheel can be used when working on large pieces. Exceptionally long parts can be ground or polished on this machine, as the offset feature prevents the interference by the front of the motor which is so common with the ordinary machine.

Besides permitting work on large or long pieces, the offset motor construction, it is claimed, allows wearing the grinding wheels down much farther than is possible with any other type of grinder. This economy is particuarly desirable where automatic polishing equipment is used.

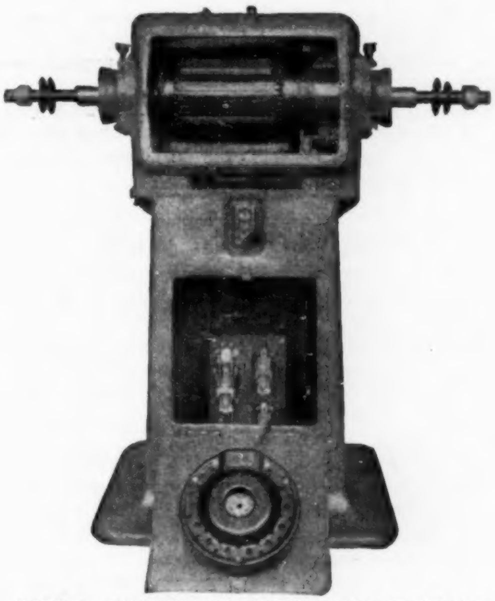
Wiring, control mechanism, and ventilation are concentrated in the pedestal, accessible when necessary, and yet protected in the ordinary course of use. An automatic push-button type starter, specially designed for this service, is inside the base of the pedestal, as is the field rheostat speed control. These machines are wired complete, ready to connect to the line without changes or additions in the way of cutouts, disconnecting switches or other extra equipment.

Ventilation of the motor is through ducts in the base of the pedestal, circulating a clean air supply from the bottom of the pedestal, and providing ample volume of air for motor ventilation. The dust covers shown prevent the entrance of dirt or dust from near the wheels or the top of the machine.

All interior part are readily accessible, even though the entire machine is enclosed for protection to the motor and other parts. Attention is called to the large commutator surfaces, the extra large high carbon steel shaft and the oversize ball bearings. The motor, built in, is especially designed and built for this service.

Among the plants using Roth polishers and grinders are the Western Clock Company, Ford Motor Company, Edison Electric Appliance Company and Stromberg Motor Devices Company.

Grinding motors are the same in general application as polishing motors, but are designed for different speeds. Grinders are supplied with two sets of flanged nuts, guards, and rests, while



DIRECT CURRENT POLISHING AND GRINDING MOTOR CUT AWAY TO SHOW DETAILS OF CONSTRUCTION

polishers are furnished with flanges and nut on left end of shaft, and a removable tapered shaft at the right end.

Alternating current polishing and grinding motors are built in the same types and with the same features of pedestal mounting, etc., as the direct current motors illustrated opposite. The A. C. motor is the standard Roth squirrel cage type.

VICTORY POLISHING AND BUFFING LATHE

The Victory polishing and buffing lathe, made by the Hill-Curtis Company of Kalamazoo, Mich., is an outgrowth of the line of machinery purchased by the above company from the Webster & Perks Tool Company of Springfield, Ohio, in 1921. After acquiring this line, the Hill-Curtis Company made a study of the market and decided that a thoroughly standardized lathe was needed. Such a lathe must have anti-friction bearings, preferably of a type which can be adjusted for wear by anyone.

VICTORY POLISHING AND BUFFING LATHE

This decision resulted in the design of the Victory lathe. The lathe is built complete in their own manufacturing plant, and in such quantities, due to its standard design and construction, that it can be placed on the market at a price, it is claimed, far lower than many other builders have been asking for lathes of the same dimensions and weight; this in addition to the fact that the Victory lathe includes Timken roller bearings.

The manufacturers state that this type of lathe is far superior to the babbitted bearing machines and also to the ball bearing equipment, as The Timken roller bearings are much easier to adjust for wear.

The illustration shows a Victory lathe of the standard type.

DIXON SAND CRUCIBLES

The Joseph Dixon Crucible Company, Jersey City, N. J., is making a line of assay (sand) crucibles and assay laboratory supplies which include the following items:

Platinum melting crucibles; scorifiers; roasting dishes; cupels, regular and safety bases; portable gold furnaces; clay or graphite mufflers.

METAL PROTECTING SOLUTIONS

The Quigley Furnace Specialties Company, 26 Cortlandt Street, New York, has put out a line of rust and corrosion preventing solutions, called Quigley Triple-A Solutions. They are applied on metal, concrete and other surfaces. A gallon of solution will cover 300 to 400 square feet of iron or steel and will stand 600° F. without cracking.

They should not be applied over painted surfaces and must not be mixed with other paints, thinners or dryers.

If it is necessary under some conditions to apply these solutions on old paint or corroded surfaces, the solution will penetrate the paint and rust and go right through to the metal itself. This coating will lift the old paint and rust so that it can be easily brushed off and the Triple-A Solution then applied to a clean metal surface.

The solution, when applied, can be washed with lye, potash, caustic soda or other cleaning compounds. They are furnished in several colors. On metal the base coat must be black. Over this, other colors may be applied.

CORED SOLDER WIRE

Fluitin cored solder wire is distributed by the Meritas Commercial Company, Inc., 11 Water stret, New York, N. Y. It is recommended for soldering almost all metals, including copper, zinc, brass, bronze, lead, nickel, iron, steel, etc. It is self-fluxing and acid free. It is used in electric lamp manufacturing, radio, scientific instruments, automotive industry, typewriters, canning, and plumbing.

One of the advantages claimed for Fluitin is that during the process of soldering, the filling will not run out or be in any way affected by heat. The tube closes immediately after each soldering process and no solder is lost. A high binding strength is claimed and an ease in application result in considerable savings of labor and materials.

TURNER SINGLE SPINDLE COCK GRINDER

The single spindle cock grinder made by the Turner Foundry and Machine Company, 3632-34 N. Lawrence Street, Philadelphia, Pa., is a development of an old machine formerly made in the Middle West. It is said to be adapted for all classes of ground key work up to 2" and for use in shops where they make cocks in small quantities, up to 200 a day. It is also claimed to be very useful and economical in the larger shops for grinding small quantities of special cocks where it would not pay to set up an automatic machine.

TURNER GRINDER

The Turner Foundry and Machine Company, due to its expansion into various lines has increased its foundry and built a modern fire-proof machine shop adjoining, all under one roof, in order to facilitate increased production and to improve their service. This change unites in one plant, the foundry and machine shop which were formerly operated in different sections of Philadelphia.

The combined buildings are of the one-story type, L-shaped. The foundry building is 40 x 150 feet, and the machine shop is 91 x 71 feet.

In the machinery department it is the intention of this company to specialize on their automatic cock grinders which have been featured for many years.

EQUIPMENT AND SUPPLY CATALOGS

Cold Strip Machinery. Blake and Johnson Company, Waterbury, Conn.

Electric Heat in Industry. General Electric Company, Schenectady, N. Y.

Arc Welder. Type WD-11. General Electric Company, Schenectady, N. Y.

Automatic Switching Equipment. General Electric Company, Schenectady, N. Y.

Curtis Steam Turbine Generators. General Electric Company, Schenectady, N. Y.

Calendar. Roessler and Hasslacher Chemical Company, 709 Sixth avenue, New York.

814 Months Ago. A resumé of the growth of I. S. Spencer's Sons, Inc., Guilford, Conn.

Optimus Plating Barrels. Bulletin No. 105. A. P. Munning & Company, Matawan, N. J.

Gas Engine-Driven Arc Welding Sets. General Electric Company, Schenectady, N. Y.

Daniels Plating Machine. Daniels & Orben Company, Inc., 81 Walker street, New York.

"A B C" Pressure Blowers and Exhausters. American Blower Company, Detroit, Mich.

Artificial Abrasives. Their History and Development. Norton Company, Worcester, Mass.

Selection of Fuel for the Heat Treatment of Metal. W. S. Rockwell Company, 50 Church street, New York City.

Pyrene Metal Finishing Service. Metal Finishing Division, Pyrene Manufacturing Company, Newark, N. J.

Full Automatic Conveyors for Electric Plating and Similar Processes. Bulletin No. 104. A. P. Munning & Company, Matawan, N. J.

How to Clean. Methods employed in cleaning metal products and using Meco cleaners. Meaker Galvanizing Company, 1243 Fulton street, Chicago, Ill.

Spare the Harpoon. Advice and model letters for the sales manager in writing to the road salesman. Metropolitan Life Insurance Company, New York.

C-E Fin Furnace. A furnace to increase boiler capacity. Combustion Engineering Corporation, Combustion Engineering Building, Broad street, New York.

Service Department in Aluminum. A new department under Dr. Robert J. Anderson, instituted by Apex Smelting Company, 2554 Fillmore street, Chicago, Ill.

Service Bulletin. A digest to members, of interesting information and current reports published by the Merchants' Association of New York. This booklet replaces Greater New York, substituting boiled down typewritten items in loose leaf form for the longer but often more attractive illustrated articles which appeared in Greater New York.

ASSOCIATIONS and SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

INSTITUTE OF METALS DIVISION

HEADQUARTERS, 29 WEST 39th STREET, NEW YORK

The program for the Winter Meeting of the Institute of Metals Division, to be held February 15-17, 1926 at 29 West 39th Street, New York is tentatively as follows:

MONDAY, FEBRUARY 15

2 p. m.—Room 1101. Eleventh Floor

A. E. WHITE, Chairman.

Effect of Reheating upon the Al-Cu-Ni-Mg and the Al-Cu-Fe-Mg (Piston) Alloys—SAMUEL DANIELS, Metallurgical Engineer, Air Service, U. S. A., McCook Field, Dayton, Ohio.

Endurance Properties of Non-ferrous Metals—D. J. MCADAM, JR., Metallurgist, U. S. Naval Engineering Experimental Station, Annapolis, Md.

The Lead Antimony System and the Hardening of Lead Alloys—R. S. DEAN; L. ZICKRICK, Metallurgical Engineer, Hawthorne Plant, Western Electric Co. and F. C. NIX.

A Preliminary Study of Magnesium Base Alloys—BRADLEY STOUGHTON, Cons. Metallurgist, Lehigh University and M. MYAKE.

HOWE MEMORIAL LECTURE

4 p. m.—Auditorium. Third Floor.
PRES. J. V. W. REYNDERS, Chairman.

Twenty-five years in Metallography—WILLIAM CAMPBELL, Professor of Metallurgy, school of Mines, Columbia University.

EVENING ENTERTAINMENT

8:30 p. m.—Smoker at Mecca Temple, Mosque, 133 W. 55th Street.

TUESDAY, FEBRUARY 16

2-4 p. m.—Auditorium. Third Floor.
DR. ZAY JEFFRIES, Chairman.

Equilibrium Relation in Aluminum-Copper Alloys of High Purity—E. H. DIX, JR. and H. H. RICHARDSON.

An Atomic Picture of Duralumin and its Crystal Structure—R. J. ANDERSON, Consulting Metallurgical Engineer, Boston, Mass.

The Effect of Heat Treatment on the Microstructure of Duralumin Sheet—ROBERT J. ANDERSON.

Modification and Properties of Sand-cast Aluminum-Silicon Alloys—ROBERT S. ARCHER, Metallurgist, Aluminum Company of America, Cleveland and L. W. KEMPF.

The Microstructure of Aluminum—K. L. MEISSNER.

ANNUAL LECTURE

4 p. m.—Auditorium. Third Floor.
SAMUEL A. TAYLOR, Chairman.

Relation between Metallurgy and Atomic Structure—PAUL D. FOOTE, PH.D., Bureau of Standards, Washington, D. C.

DINNER

6:30 p. m.—Institute of Metals Division will hold its annual dinner at the Harvard Club, North Room, 27 West 44th Street. Cost of dinner, $3.00 per plate.

WEDNESDAY, FEBRUARY 17

10 a. m.—Room 2. Fifth Floor.
C. H. WITHERELL, Chairman.

The Hardness of Copper—SAMUEL L. HOYT, General Electric Co., Schenectady, N. Y., and T. R. SCHERMERHORN.

The Effect of Lead and Tin with Oxygen on the Conducticity and Ductility of Copper—NORMAN B. PILLING, Metallurgist, International Nickel Co., Bayonne, and GEORGE P. HALLIWELL.

Exudations on Copper Castings—W. H. BASSETT, Technical Superintendent, American Brass Co., Waterbury, Conn., and J. C. BRADLEY, Metallurgist, American Brass Co., Waterbury, Conn.

The Microscopical Structure of Cooper—H. B. PULSIFER, Metallurgist, Beryllium Corporation of America, Cleveland, Ohio.

2 p. m.—Room 2. Fifth Floor.
S. SKOWRONSKI, Chairman.

Some Examples of Copper made Brittle by Hot Reducing Gases—T. S. FULLER, Metallurgist, Research Laboratories, General Electric Co., Schenectady, N. Y.

Action of Reducing Gases on Heated Copper—W. H. BASSETT, Technical Superintendent American Brass Co., Waterbury, Conn., and J. C. BRADLEY. Met. Am. Brass Co., Waterbury, Conn.

The Annealing of Commercial Copper to Prevent Embrittlement by Reducing Gasses—S. B. LEITER.

The Estimation of Oxygen and Sulphur in Refined Copper—W. H. BASSETT, Technical Superintendent American Brass Co., Waterbury, Conn. and H. A. BEDWORTH.

AMERICAN FOUNDRYMEN'S ASSOCIATION

HEADQUARTERS, 140 SOUTH DEARBORN STREET, CHICAGO, ILL.

The Thirtieth Annual Convention and Second International Foundrymen's Congress will open full blast Monday morning, September 27th. It has been decided that the Exhibit will open on Saturday, September 25, be closed on Sunday, open Monday, and will continue through Friday, the closing day of the Convention.

Reasons advanced for a Saturday opening are as follows: If exhibits, especially the heavy operating types, are to be erected and ready when the convention opens Monday morning, they must be completed Saturday noon unless the exhibitors and the Association are willing to pay double time for mechanics from Saturday noon until Monday morning and put up with the many inconveniences attendant to doing this work when freight and express offices and other places of business are closed.

Perhaps the best argument in favor of a Saturday opening is the opportunity it affords foundrymen of Detroit to give some time to the exhibits before the convention opens and demands are made on their time as hosts to the throug of foundrymen who will gather from all over the world.

QUAD-CITY FOUNDRYMEN

HEADQUARTERS, EAST MOLINE, ILLINOIS

The Quad-City Foundrymen's Association held their January meeting at the Le Claire Hotel in Moline, Monday evening, January 25, 1926, at 6:30 P. M. Seventy-five members were present for the dinner and talk, which followed.

A. A. Grubb of the Ohio Brass Company of Mansfield, Ohio, has done considerable work in sand reclamation and his talk on, "Sand Conservation and Reclamation," proved of great interest.

The Ohio Brass Company, in reclaiming old sand in their Brass Foundry, have cut their sand cost to approximately one-third of the original cost, without in any way lowering the grade of their castings. Mr. Grubb stated that the mulling process is the most satisfactory in that by this method the grain particles are each well covered by the clay contents of the sand and results in the "velvety" sand, which the molder likes.

Mr. Grubb illustrated by blackboard drawings the various type instruments used in making the experiments and tests so necessary if the foundryman is to know the condition of his sand heap and what it needs to bring it to the standard best suited to his needs.

Slides illustrating different sands concluded Mr. Grubb's talk.

A. E. Hageboeck of the Frank Foundries Corporation of Moline and a Director of the American Foundrymen's Association spoke briefly of a resolution adopted by the cost committee of that Association, advocating the specifying of all casting weights on blue prints, when being submitted for quotation.

AMERICAN ELECTRO-PLATERS' SOCIETY

CHICAGO BRANCH

HEADQUARTERS, CARE OF ROBERT MEYERS, 2210 WILSON AVE.

At the Annual Banquet in the Cameo Room, Hotel Morrison, on January 23, 1926, the Educational Program was as follows:

C. W. Humphries, "Chromium and Cadmium Plating."
Erwin Sohn, "Corrosion."
Geo. B. Hogaboom, "Brass Plating."
F. T. Taylor, "Use of the Ammeter in Plating Room."

The evening was given over to dinner and a social time. There were a number of prizes for the ladies, little Miss Humphries of Indianapolis, the only child present, drawing the winning numbers from a hat. Mrs. Carlson, wife of the proprietor of the Arrow Plating Company, won first prize, a beautiful lamp, and another prize, a five dollar bill, was awarded to Mrs. E. Lamoureux.

NEW YORK BRANCH

HEADQUARTERS, CARE OF J. E. STERLING, 2595 45th STREET, ASTORIA, LONG ISLAND, N. Y.

Platers, chemists and manufacturers are asked not to forget the Seventeenth Annual Founders Day and Banquet of the New York Branch of the American Electro-Platers' Society, to be held Saturday, February 20, 1926, at the Aldine Club, 200 Fifth Avenue, (cor. 23rd St.), New York City, at 7 P. M. sharp.

Full particulars were published in the January issue of THE METAL INDUSTRY, page 39, and can be obtained from the Secretary, J. E. Sterling at the address noted.

The January meetings of the New York Branch were well

attended and the sessions of both meetings were extremely interesting. Messrs. Stremel, McStocker, and Haddow, partook in a lively discussion on the properties of chromium and its color in comparison to white gold for use in the jewelry industry. E. Shorr and George Wilson described the benefits of cadmium plating for rust-proof purposes.

Messrs. Loeb, Voss and Downes discussed the best ways of pickling nickel silver of 18 per cent quality.

At the second meeting of the month, William Voss read a paper on electric equipment in the plating room, giving detailed explanations of the differences between shunt wound and compound wound generators for plating. He described minutely the care and operation of both types of machines and answered all questions in a most satisfactory manner receiving a rising vote of thanks from the members, at the close of his talk.

Messrs. Stremel, Voss and Flanigan discussed the causes of the corrosion or breaking up of iron wire used on silver anodes in silver solutions.

Ways and means of plating die castings of zinc and aluminum were discussed by Messrs. Ruhlman, Stremel and Voss.

Mr. Dupbernell described the activities of the new British platers society, called the Electroplaters' and Depositors' Technical Society, and advised this branch to cooperate with them.

ROCHESTER BRANCH

HEADQUARTERS, CARE OF CLARENCE A. REAMA, 512 LYELL AVE.

The Rochester Branch of the American Electro-Platers' Society will hold their Fourteenth Annual Banquet, Saturday evening, February 13, 1926, at 6:30 P. M. at Powers Hotel. Electro-platers or any one else who is interested in higher education in this work are invited to be present at this banquet. Platers or chemists are invited to join as a member of the Society.

Reservations, also information about the Society, and the qualifications required to join, can be had by addressing the secretary, Clarence A. Reama, at the above address.

The cost of the banquet is $3.00 per ticket. There will be entertainment and dancing.

INTERNATIONAL FELLOWSHIP CLUB

HEADQUARTERS, CARE OF J. C. OBERENDER, ZAPON COMPANY, NEW HAVEN, CONN.

Those engaged in producing and selling products for the plating craft will meet together at a luncheon Saturday, February 20, 1926. It will be held at 1 P. M. in the Aldine Club and will be all out and over with before the meeting at 3 P. M. of the New York Branch, American Electro-Platers' Society.

The International Fellowship Club is a body entirely foreign to the American Electro-Platers' Society and is made up exclusively of those engaged in the selling end of the business. Therefore the talks, etc., will be along lines different from those interesting to the man engaged in plating.

It is requested by the International Officers that all men eligible for membership in the Club be present at this meeting at 1 o'clock.

The officers are as follows: Chairman—Wilfred S. McKeon, Greensburg, Pa.; vice-chairman—Geo. J. Lawrence, 3727 Pine Grove Ave., Chicago, Ill.; secretary—John C. Oberender, 185 Church St., New Haven, Conn.

BRITISH INSTITUTE OF METALS

HEADQUARTERS, 36 VICTORIA STREET, LONDON, S. W. 1, ENGLAND

Papers to be read at the February, 1926 meeting are as follows:

BAILEY, R. W.: "Note on the Softening of Strain-Hardened Metals and its Relation to Creep."

CROW, T. B.: "Some Experiments on the Soft-Soldering of Copper."

BANNISTER, Professor C. O.: "Note on the Corrosion of an Ancient Tin Specimen."

EVANS, B. S. and H. F. RICHARDS: "Determination of Zinc Oxide in Brass."

FEITKNECHT, W. Dr. chem. (Berne, Switzerland): "Crystal Growths in Recrystallized Cold-Worked Metals."

GENDERS, R.: "The Interpretation of the Macrostructure of Cast Metals."

HOYT, Samuel L., and T. R. SCHERMERHORN (Schenectady, N. Y., U. S. A.): "The Hardness of Cold-Rolled Copper."

HUME-ROTHERY, W.: "Researches on the Nature, Properties and Conditions of Formation of Intermetallic Compounds. I-V. I.—The application of the phase rule to systems containing intermetallic or other compounds, and the interpretation of certain points in connection with equilibrium diagrams; II.—The nature of intermetallic compounds; III.—The nature of metallic phases of variable composition; IV.—The system Calcium-tin; V.—The system Magnesium-tin."

KENT, W. L.: "The Brittle Ranges of Bronze."

LOBLEY, A. Glynne, and Douglas JEPSON: "The Influence of Gases on Copper at High Temperatures. Part I."

MORTIMER, George: "The Die-Casting of Aluminium Alloys—A Review of Current Methods."

MURPHY, A. J.: "The Constitution of the Alloys of Copper and Tin."

PORTEVIN, A. M. (Paris, France): "Striation due to working or to Corrosion in Microscopical Metallography. A Contribution to the Study of the Mode of Action of Etching Agents."

STOCKDALE, D.: "The Copper-Rich Aluminium-Copper Alloys."

TAPSELL, H. J. and J. BRADLEY: "The Mechanical Properties at High Temperatures of an Alloy of Nickel and Copper, with Special Reference to Creep."

Personal

FREDERICK V. LINDSEY

Frederick V. Lindsey has been appointed sales manager of Resistance Materials by the Driver-Harris Company. Mr. Lindsey has been identified with the manufacture of nickel and nickel alloys for a great many years, being vice-president and secretary of the Electrical Alloy Company which was purchased by Driver-Harris Company. It was under his supervision that the facilities of The Electrical Alloy Company were increased from a small wire drawing mill with limited production to one of the leaders. His efforts will be concentrated in his new appointment on the manufacture and sale of "Nichrome" for industrial and domestic applications.

C. E. Nelson has been appointed advertising manager of the Stanley Works, New Britain, Conn.

E. P. Reinhard, of Anode Corporation of America, New York, is on an extended business trip in the Middle West.

D. L. Bellinger has been elected president of the Mount Morris Valve Corporation, and is now located in Mount Morris, N. Y.

Edwin Smith, Jr., consulting chemical engineer of Orange, N. J., has become connected with the Chemical Treatment Company, New York.

Guy E. Wyatt has been appointed advertising manager and assistant sales manager of the American Foundry Equipment Company, New York. He succeeds Robert H. Kelly.

W. La Coste Neilson, vice-president and general sales manager Norton Company, Worcester, Mass., manufacturer of grinding machines and grinding wheels, is in Europe studying business conditions there.

George Cotton has been promoted to the superintendency of the Walworth Company's Kelley-Jones plant at Greensburg, Pa. He was formerly superintendent of shops at the Kewanee, Ill., works of the Walworth Company.

Charles Schor has severed his connection with the Empire

Lighting Fixture Company, of New York, and is now with the Neo Gravure Company, of New York, in charge of the copper depositing in cylinder grinding department.

R. E. Massicotte has resigned his position with the Irvin Electric Lighting Fixture Company, of New York, and has accepted a position with the Horn and Bremen Electric Fixture Company, 427 Broad street, Philadelphia, Pa.

R. H. Pellington, who was formerly with the Zeller Lacquer Manufacturing Company, New York, will represent the Miner Edgar Company, New York, in the states of Connecticut, Rhode Island and the southern part of Massachusetts.

Upon the resignation of superintendent, A. J. Palmer, the Empire Brass Manufacturing Company, Ltd., London, Canada, has appointed **Herbert Smith,** as general superintendent. Mr. Smith was formerly superintendent of Jenkins Bros. of Montreal.

W. G. Adams, who was connected with the Wolff Manufacturing Corporation, Chicago, Ill., for the past nineteen years as foreman in the brass foundry, is now with the Republic Brass and Manufacturing Company, Los Angeles, Cal., as foreman of the brass foundry.

Sheldon W. Hughes is now connected with the Diamond Bronze Company, Cleveland, Ohio, in the capacity of vice-president and sales manager, having resigned as manager of sales and service of the construction department of the John Harsch Bronze Foundry Company, Cleveland. Mr. Hughes has been connected with the latter company since shortly after its organization.

The January lecture of the John Howard Appleton series was delivered by **Dr. Colin G. Fink** in the Metcalf laboratory of Brown University. Dr. Fink chose as his subject "The Électrolytic Restoration of Ancient Bronzes," covering the researchers that he and Charles H. Eldridge have been conducting at Columbia University and the Metropolitan Museum of Art, New York.

A. Doster, secretary of the Torrington Manufacturing Company, Torrington, Conn., expects to take a trip abroad, leaving on or about March 15, 1926. The trip will be essentially one for pleasure, and Mr. Doster will join his wife and two children who have been in Europe since last October. He also expects to visit the firm's English associates, W. H. A. Robertson & Company, of Bedford, England.

Royal F. Clark, for the past seven months foreman of the electro-plating department at the Langenau Manufacturing Company, Cleveland, Ohio, was compelled to return to his home in Newark, N. J., on December 18, 1926, suffering from rheumatism. Mr. Clark has now completely recovered, and has resigned his position in Cleveland to accept a position with the Wilcolator Company, of Newark, as foreman of the plating and polishing departments, a new installation.

John C. Bannister, vice-president in charge of engineering of Walworth Company, who decided several months ago to retire from active work on January 1st, was given a farewell dinner at the Harvard Club in Boston, December 21st. There were present 28 men, including the executive officers of the company and a number of Mr. Bannister's most intimate associates in the Boston offices. F. H. Morehead, chief engineer of the company, will take over Mr. Bannister's responsibilities.

Cassius C. Chaney was recently elected vice-president of the General Refractories Company, Philadelphia, Pa., having formerly been general manager. He has been identified with companies manufacturing refractories for eighteen years. Starting with the American Refractories Company in 1906, he later became superintendent of its silica brick works at Rockdale, Ill. He was appointed district manager of Danville Refractories Company, Danville, Ill., in 1915. In 1916 he left that organization to superintend the building of a silica brick works at Joliet, Ill., for the General Refractories Company, continuing as superintendent of that works until January, 1924, when he was appointed general manager of the company.

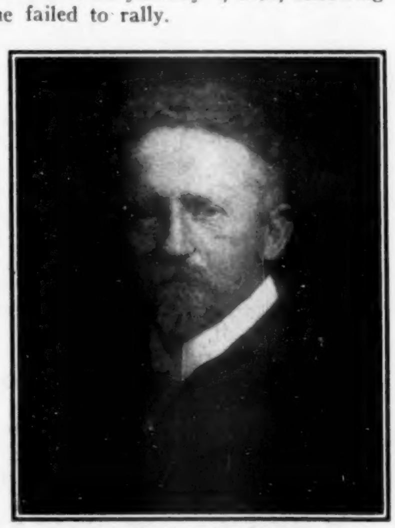
Frank H. Howe, president of the Columbus Wire & Iron Works Company, has retired from the presidency of the National Association of Ornamental Iron and Bronze Manufacturers after serving three terms of one year each. Mr. Howe has declined any further re-election. The organization more than doubled its membership during his term of service. On his retirement, the Iron League of Philadelphia, the local branch of the Ornamental Bronze Association, presented him with a gold watch fob similar to the one presented to **W. F. Kendrick,** Mayor of Philadelphia, at the same meeting, and the National Association presented the retiring president with a very fine gold watch. **R. P. Liphart,** president of the Richmond Structural Steel Works, was elected successor to Mr. Howe.

Obituaries

DR. KARL GOLDSCHMIDT

Dr. Karl Goldschmidt, whose death was noted in our January issue, was the head of the well known firm of Th. Goldschmidt, A. G. of Essen, Germany. He died on January 4, 1926, following an operation from which he failed to rally.

Mr. Goldschmidt was approaching his seventieth year and had long been prominent in the business and scientific world, both here and abroad, not only as the active head of Th. Goldschmidt, A. G., but also on account of extensive chemical research and development work, particularly in connection with processes for the detinning of scrap tin plate, upon which subject he was regarded as a recognized authority.



DR. KARL GOLDSCHMIDT

In partnership with his younger brother, the late Prof. Hans Goldschmidt, inventor of the well known Thermit Process and who died in the early part of 1923, Dr. Karl Goldschmidt carried on the enterprise founded by his father, and brought it to its present dominant position among German industries. He was also one of the founders and original directors of the Goldschmidt Detinning Company, now the Metal and Thermit Corporation, of 120 Broadway, New York City.

Endowed with rare vision and energy, Dr. Goldschmidt was exceedingly progressive in his social ideas and took an active interest in the welfare of his employees, being instrumental in the establishment of old age and invalid pensions from which workmen with over 10 years of service were entitled to relief. On the celebration of his first 25 years of service as the head of his firm, he set aside a large sum from his private fortune, for the establishment of a suitable home for those of his employees who after illness might need a quiet place at which to rest and recuperate. It also served as a country club where employees could spend their vacations.

Dr. Goldschmidt is survived by his widow, two sons and a daughter; his oldest son, Dr. Theodore Goldschmidt, succeeding his father as active head of the German firm.

JOHN M. WITTERS

John M. Witters, manager of the Milwaukee branch of the E. J. Woodison Company, Detroit, foundry and shop supplies, died December 13, 1925, in a Milwaukee hospital shortly after being stricken ill on the street. He was 55 years of age.

Mr. Witters was with the E. J. Woodison Company for nine years prior to his death, as manager of the Milwaukee branch. But during the month of December, 1925, there was organized the Witters Foundry Supply Company, to take over the territory heretofore allotted to the Milwaukee branch by E. J. Woodison. Mr. Witters' death was most untimely.

His original entry to the foundry business was when he was quite young, with the old Dayton Malleable Company, Dayton, Ohio. From there he went with the Whiteley Steel Company in Muncie,

Ind., and managed their sales for a good many years. After leaving them he connected himself with the E. J. Woodison Company and was with them until the time of his death.

MELZAR H. MOSMAN

Melzar Hunt Mosman, 81, noted sculptor and designer, regarded by his fellow-sculptors as one of the world's foremost bronze founders, died at his home in Chicopee, Mass., recently. The crowning achievement of his career was the casting of the massive bronze doors on the west wing of the Capitol at Washington. His father cast the east doors.

CHARLES E. McFARLAN

Charles E. McFarlan of Cincinnati, Ohio, for thirty years president of the William Powell Company, brass founders, died in that city on January 3, 1926. Mr. McFarlan was 76 years old.

HARRY F. JOHNSON

Harry Frapie Johnson, 54, of the firm of J. W. Johnson & Co., manufacturing jewelers of New York, died recently at his home, 1220 Watchung avenue, Plainfield, N. J.

NEWS OF THE INDUSTRY

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

NEW ENGLAND STATES

WATERBURY, CONN.

FEBRUARY 1, 1926.

City assessments of property for the purpose of taxation, shows the **Scovill Manufacturing Company** leading the list as the biggest taxpayer for the present year. Its taxable property is rated at $14,110,470. This includes not only the Scovill plant proper, but also the **American Pin Company** in Waterville and part of the **Oakville Company,** the other part of the latter company being taxed in the town of Watertown.

The machinery of the Scovill company, alone, is valued at $3,500,000. The buildings at the main plant are assessed at $4,495,000. The American Pin plant in Waterville is valued at $1,106,850 and the part of the Oakville plant which lies in Waterbury is valued at $299,600.

The **American Brass Company** comes second on the list, with a total valuation of $11,214,130. This, of course, is for the local plants alone and does not include the valuation of those in other cities. The assessment of the **Chase Companies, Inc.,** including the **Waterbury Manufacturing Company, Chase Rolling Mills, Chase Metal Works** and subordinate plants, is set at $10,190,520.

The American Brass Company is among the 100,000 federal taxpayers who shared in the $151,885,415 refunded out of collections by the treasury department during the last fiscal year, It received a refund of $118,404 as the result of readjustment.

Construction of a $250,000, three-floor factory building, will be started by the **Lux Clock Company** this spring, officials of the concern stated, last month, following the board of directors' meeting. When the new building is completed the company expects to increase its personnel to more than 500. Increase of the capital stock from $200,000 to $300,000 was voted, and a 10 per cent cash dividend was declared, payable immediately. The new building will be erected on the company's property adjoining its present plant on Sperry street. It will have a frontage of 300 feet; will be of brick with many windows. Attractive approaches will keep the building in harmony with the residential section to the north. The former officers were reelected, consisting of: President, **A. A. Tanner;** vice-president, **Henry Weyand;** secretary, **Harry A. Soper;** treasurer, **Paul Lux;** assistant treasurer, **Frederick Lux;** assistant secretary, **Herman Lux.**

The 1925 output of fabricated copper and brass products from the combined plants of the **American Brass Company** and the plants of the **Anaconda Company** at Great Falls is calculated at 790,000,000 pounds. Orders on the books are said to be one-third larger than at the beginning of 1925.

John H. Goss, vice-president and general superintendent of the **Scovill Manufacturing Company,** has been reelected vice-president of the Connecticut Manufacturers' Association and a member of the executive committee.

All the former directors of the **American Brass Company** were re-elected at the annual meeting of the stockholders held in Waterbury, February 2, 1926. They are: **Charles F. Brooker,** Ansonia; **John D. Ryan,** New York; **Cornelius F. Kelley,** New York; **John A. Coe.** Waterbury; **Benjamin B. Thayer,** New York; **Edward L. Frisbie,** Waterbury; **Clifford F. Hollister,** Waterbury; **E. H. Yates,** Waterbury; **George H. Allen,** Buffalo, N. Y.

On the following day, all officers were re-elected at the annual meeting of the directors held in New York. **Charles F. Brooker** was re-elected chairman of the board and **John A.** Coe re-elected president, the other officers re-elected being: Executive vice-president, Edward L. Frisbie; treasurer, Clifford **F. Hollister;** secretary, **Edmund H. Yates;** assistant treasurers, **Major W. Judge** and **S. Burnham Terry.**—W. R. B.

BRIDGEPORT, CONN.

FEBRUARY 1, 1926.

A rumor that the **Remington Arms Company** of this city is involved in the pending acquisition of the **National Cash Register Company** by **Dillon, Read & Company** has been denied by officials of both companies. The original report was that the proposed reorganization of the Cash Register Company by the financial firm was for the purpose of raising funds for the acquirement of the Remington company or of its cash register business. This was believed to be hinted at in the report given out by the financial firm when the reorganization was broached, that "there would be considerable widening of the scope of the activities of the Dayton industry."

"The Remington company has never figured in the deal," declares **J. H. Barringer,** first vice-president of the Cash Register Company. "It has never been thought of and I can say that Frederick B. Patterson, our president, intends to keep active control of the business here." Another basis for the report has been suggested in the recent litigation between the two companies over patent rights. That this litigation furnished any basis for the rumor was also denied by Mr. Barringer.

Both increases and decreases in assessment of local factories are noted in the 1925 tax list of the city, just made public The **Remington Arms Company** receives the largest increase, its increase being $306,683 and total assessment now being $3,364,845. The **Bryant Electric Company** has been increased $228,921, its assessment now being $2,282,955. The **American Tube and Stamping Company** has been increased nearly $100,-000 to $2,171,201.

The **Bridgeport Brass Company** assessment has been reduced $300,866; **Bridgeport Metal Goods Company,** decreased $10,796; the **Bridgeport Hardware Manufacturing Company,** decreased $12,000; the **Bilton Machine Tool Company,** decreased about $85,000; the **Singer Manufacturing Company,** decreased $265,100, and the **General Electric Company,** decreased $236,700.

The assessment of the **American Chain Company** has been reduced $964,690; that of the **Bridgeport Hydraulic Company,** $895,816 and that of the **Columbia Phonograph Company,** decreased $978,688. These are the largest decreases, the reason for the latter company's decreases being the sales during the year of much of its property and machinery. The other two

companies mentioned now have appeals pending before the superior court against assessment levied against them in 1924 which have not yet been settled. The reduction in assessments, the tax assessor states, was due to an investigation made by his office.

A conference of the eastern branch of the sales managers of the **Dictaphone Company** was held at the Dictaphone plant here, last month. **A. V. Bodine,** vice-president of the company, in charge of manufacturing, reported that the managers had a very optimistic outlook for the next six months.

Elias H. Milnor, bookkeeper for the **Holmes and Edwards Silver Company,** was stricken suddenly with a heart attack while on his way to work, January 7 and died while being taken to the hospital. He was 62 years old. He had been employed by the silver company for the past 32 years. He is survived by a daughter, Mrs. R. C. Hitchcock, a sister and brother in Baltimore and a brother in Chicago. The funeral was held from his home, 12 Fairmount terrace, Jan. 9.—W. R. B.

TORRINGTON, CONN.

February 1, 1926.

Torrington's new grand list totals $28,869,869, an increase of about half a million over last year's list. Mills and manufactories are valued at $5,959,626, and the goods of manufacturers, etc., at $3,372,331. The various metal plants are assessed as follows: **American Brass Company,** $3,885,180; **Union Hardware Company,** $1,025,192; **Hendey Machine Company,** $980,302; **Torrington Company, Standard Plant,** $942,710; **Torrington Company, Excelsior Plant,** $908,799; **Turner & Seymour Manufacturing Company,** $367,670; **Torrington Manufacturing Company,** $272,656; **Progressive Manufacturing Company,** $247,208; **Fitzgerald Manufacturing Company,** $128,820.

Charles S. Brooker, for many years employed at the **Coe Brass** plant but retired on a pension some years ago, died at his home here on January 12. He was 72 years of age. Death was due to arterio sclerosis. The deceased was a cousin of **Charles F. Brooker,** chairman of the board of directors of the **American Brass Company.**—J. H. T.

NEW BRITAIN, CONN.

February 1, 1926.

Mid-winter finds industrial conditions in New Britain excellent, with all of the factories working on a full time schedule with a full complement of employes and no indication of any change for the worse. Employment conditions here are excellent, especially in the skilled trades.

Reflecting the demands of business, a new factory building 360 by 60 is soon to be erected for the **Russell and Erwin** division of the **American Hardware Corporation,** affording 43,200 square feet of floor space for manufacturing and office purposes. The estimated cost is $175,000. The contract has been taken by the **Aberthaw Construction Company** of Boston and four or five months will be required for the completion of the building which is of steel and concrete construction two stories in height. Incidentally, it will be the longest building in this branch of the Hardware Corporation and will be so built as to provide for raising it to four stories at any time.

Landers, Frary & Clark, makers of high grade cutlery, household utensils of pressed aluminum and electric equipment, are finding it difficult to keep abreast of their business orders and the **Stanley Works,** wrought steel butts and hinges and cold and hot rolled steel, are likewise very busy.

The **Hart and Cooley Company,** makers of steel lockers and heat registers, are occupying their new factory addition and are finding business excellent. The same holds true of the **Fafnir Bearing Company** while in the neighboring city of Bristol the **New Departure** branch of the **General Motors Company** is rushing along at capacity turning out both ball and roller bearings as one of its major productions for the motor car industry.

Outlook for spring business is good. Reports from returning salesmen augur well for this coming year.—H. R. J.

MIDDLE ATLANTIC STATES

ROCHESTER, N. Y.

February 1, 1926.

With the new year less than a month old business conditions in Rochester are already beginning to show that seasonal lassitude, but the slackening that invariably follows the holiday period has spent its force and renewed vigor is in sight. In spite of the fact that industrial activities in all manufacturing lines underwent a let-down, institution employing metals have not receded one whit from the high speed attained in November last.

Unusual activity continues in the brass foundries and metal-plating plants about Rochester. Just what has created this strong demand just now is not clear, unless it is the result of the quiet season experienced last Summer and early Fall. Every foundry in Rochester is running at full speed, and practically all of the production is taken by local patrons.

Operations at the General Railway Signal plant in Lincoln Park are said to be at 100 per cent at this time, the concern thus maintaining the high standard of production that began last Fall when the company secured so many large railway equipment orders about the country. Better business is reported by the perforating plants in Rochester, as well as the **Stromberg-Carlson Company** and **Todd Protectograph Company. Yawman & Erbe** are turning out a larger volume of office furniture and devices than usual at this time of year.

Locke & Company, of New York, have taken over one of the **Symington** war plants, known as **"Plant B,"** of the **General Electric Company,** and will use it for the manufacture of automobile bodies. The company expects to turn out about twenty to thirty semi-custom and semi-production closed bodies daily. The plant will employ 800 men, it is said, and will be in operation in three weeks.—G. B. E.

TRENTON, N. J.

February 1, 1926.

Business continues to be good among the metal manufacturers of Trenton and a busy spring is looked forward to. The fact that there are labor troubles pending is very encouraging to the metal trade. Considerable building operations are promised for the spring and summer and with the pottery trade increasing the manufacturers can only see plenty of business ahead.

The Trenton Emblem Company has let a contract for a new melting room at the Hamilton avenue plant.

Ferdinand W. Roebling, Jr., member of the firm of **John A. Roebling's Sons Company,** has been awarded a silver loving cup as the Trentonian having performed the greatest and most unselfish service for his city in the last year. One cup is provided for recognition of the "first Citizen" each year by a newspaper. The award is made by representatives of business and civics clubs. Mr. Roebling's signal service for 1925 was the leadership of a drive to collect $500,000 for a Trenton hospital. The presentation of the cup was made by Governor Moore.

Lewis Lawton, contractor and manufacturer and president of the **Jonathan Bartley Crucible Company,** recently celebrated his seventy-second birthday. Mr. Lawton enjoys good health and daily attends to his business interests. The celebration was in the nature of a family reunion.

Following concerns were incorporated here: **Condensation Products Corporation,** Newark, N. J., manufacture chemicals, $200,000 capital; **Kingsland, Products Corporation,** Newark, N. J., manufacture chemicals, $125,000 capital; **Ruehl & Hatfield, Inc.,** plumbing supplies, Newark, N. J., 1,000 shares no par; **Hilton & Schanzenbach,** Trenton, N. J., $100,000 capital, radios and batteries; **H. M. Ash Company,** Paterson, N. J., $125,000 capital; hardware; **Elite Radio Tube Company,** Newark, N. J., $100,000 capital; radio supplies; **Studerus Oil Heating Corporation,** Union City, N. J., $50,000 capital, deal in oil heaters; **Golaf Electric Corporation,** Newark, N. J., 1,000 shares no par; electrical fixtures; **Annandale Graphite Corporation,** Camden, N. J., $2,000,000 capital, to engage in mining minerals.—C. A. L.

PITTSBURGH, PA.

February 1, 1926.

In the metal industry improvement is noted in some lines, although other lines are still quiet, but at the present time optimism is general.

Announcement has been made of a merger of the **Equitable Meter Company,** with offices and plant at 424 First avenue, with the **Pittsburg Model Engine Company,** Lexington avenue. The new company is to be known as the **Equitable Meter and Manufacturing Company,** with a capital stock of **$1,500,000** and, after April 1, will have the business of the concern combined in one building in the Homewood section of this city.

The merger forms a company with all its officers and board of directors Pittsburghers with one exception. **W. F. Rockwell,** president of the concern, is a non-resident. The other officers are **T. H. Gillespie,** treasurer; **James Stoughton,** assistant treasurer, and **Colonel Paul R. Hawkins,** secretary. The board of directors consists of **A. W. Thompson, J. Frank Drake, Henry G. Phillips** and **Otto F. Felix.**—H. W. R.

MIDDLE WESTERN STATES

DETROIT, MICH.

February 1, 1926.

The **Dohn Aluminum & Brass Corporation,** has recently spent $350,000 in providing plant and manufacturing facilities for a new patented aluminum piston which is said to be impervious to heat.

The **Founders Sand & Supply Company,** of Detroit, is the only Michigan organization owning its own molding sand property, the plant being located at New Lexington, Ohio. The business is directed by **H. A. Mendelson,** president and treasurer. **S. L. Fitzpatrick** is vice president and **B. E. Kuhn,** secretary. **William F. Grogan** is assistant secretary.

After an illness of several days, **Charles A. DuCharme,** former president of the **Michigan Stove Company,** died December 28, from pneumonia. He was 67 years old.

The **Standard Pattern Plating Company** has recently been incorporated at Detroit, for the purpose of engaging in a general manufacture of aluminum and brass, and doing jobbing work. The owners are **John Kuehnle,** 4011 Whitney avenue; **Gabriel Jobbagy** and **Julia Parker,** all of Detroit.

H. P. Mackinnon is now associated with the **Great Lakes Foundry Sand Company,** of Detroit, in a sales and engineering capacity. He has been affiliated with the foundry industry in an executive capacity for the past twenty years, and for the last eight years as sales engineer with the **William H. Nicholls Molding Machine Company,** at Brooklyn, N. Y.

It is announced that the **Manning Abrasive Company, Inc.,** at Troy, N. Y., has established a branch warehouse and office at Grand Rapids, Mich.

Detroit even at this early date is making plans for the second international and the thirteenth annual foundry convention of the American Foundrymen's Association, which will be held here in September. It is expected about 6,000 delegates will attend the gathering. Among those active in the plans are **Jesse L. Jones,** Pittsburgh, and **Fred Erb,** of the **Joyce Foundry Company,** at Vassar, Mich.

The **Alloys Foundry Company,** has been incorporated at Detroit with a capital stock of **$75,000.** The owners are **A. M. Thompson,** 19 West Woodbridge street, Detroit, **R. L. Spitzley,** and **E. O. Jakel,** also of Detroit.

A new type of aluminum alloy castings, formerly used only in aviation engines, is now used by the **Cadillac Motor Car Company** on three main bearing caps of its crankshaft. Former practice was to use an alloy of aluminum with copper, which had the required stiffness, but needed to be reinforced with a steel plate. In the new practice a quality of aluminum known as Y-metal with a mixture of nickel, copper and magnesium is cast into a steel die, instead of in sand, and is used for the bearing caps with great success.

The **American Brass Goods Company,** at Grand Rapids, is soon to start on the first unit of its new factory, it is announced.

The **Kalamazoo Blow Pipe Company,** at Kalamazoo, has increased its capital stock from $50,000 to $75,000. It is understood the new capital will be used for expansion purposes.—F. J. H.

CHICAGO, ILL.

February 1, 1926.

The metal market was spotty during the last week in January. Chicago users appeared to be covered for their immediate needs so when the European market took on a bearish tinge, they sat tight and refused to venture into the future until such time as the market stabilized.

Chicago will require 37,000 new homes, either bungalows or single apartments, to be constructed during 1926 to overcome finally the housing shortage of war years, according to an estimate made by Health Commissioner **Herman N. Bundesen.** After 1926, he estimates that 22,000 bungalows or single family apartments will take care of the city's normal requirements.

Patterson Specialties, Inc., 3905 North Western avenue, has been incorporated with a capital stock of $1,000 to buy and manufacture automobile and metal specialties. Incorporators: Carroll J. Lord, Russell F. Locke and N. L. Olson. Correspondent: Ashcraft and Ashcraft, 134 South LaSalle street.

Annex Corporation, 3532 Wentworth avenue, has been incorporated to buy, sell and manufacture metal spring covers and automobile accessories. Incorporators: I. A. Simon, Fred Schlesser, L. J. Rothenbecker and Matthew Bloomer. Correspondent: F. E. Croarkin, 1617 Ashland Block.

Lapham Hickey Company, 1625 W. Pershing Road, has been incorporated with a capital of $50,000, to manufacture and deal in zinc, manganese, coke, copper and other materials. Incorporators: R. F. Fitz Simmons, F. E. Hickey, E. B. Lapham and R. P. Lapham. Correspondent: E. A. Frost, 29 S. La-Salle street.

The **Chicago Automatic Conveyor Company** has acquired three acres of industrial property at the southeast corner of 74th street and Oakley avenue as a site for a plant the company plans to build.

J. W. Johnson, of the **Johnson Shuttle Company,** is receiving bids through his architect, Carl M. Almquist, for a one-story factory building, 75 by 122 feet, of pressed brick and stone front to be built on North Kedzie avenue. Estimated cost, $30,000.

M. A. Sokoloff, manufacture of metal products is receiving bids through his architects, A. M. Friedman and W. G. Langenbeim, for a two-story factory building, 49 by 120 feet, of pressed brick and stone front to be built at 4649-51 W. Harrison street.

Lathrop-Paulson Company, manufacturer of milk cans and bottle washing machines, is receiving bids on a two-story factory building, 36 by 120 feet, to be erected at 2447 West 48th street, at an estimated cost of $18,000.—L. H. G.

OTHER COUNTRIES

BIRMINGHAM, ENGLAND

January 15, 1926.

Of the non-ferrous metal trades generally it may be said that the year has shown steady progress with a gradually expanding activity. The copper trades have been assisted by remarkably low copper prices which have brought a corresponding reduction in selling values. This downward movement has been assisted by the improved machinery and reorganization of the working of the shops, having the general effect of speeding up. In the brass trade the persistent maintenance of high prices for spelter has kept up working prices, but in this trade also possibilities have been largely utilized in the direction of cheapening production. Makers of aluminium sheets have found a continuous and large demand from the motor trades increasingly using aluminium for engine

working parts, bonnets, etc. This trade turns the year with excellent forward bookings which will keep the mills busy for some time.

Probably no industry has gone forward more rapidly than the nickel trade owing to the increasing use of this alloy as an ingredient for high class steel and other special lines. The principal concerns devoted to the production of this metal have largely increased their capacity during the year and the prospects indicate enormous expansion in future, especially in view of the extensive research being applied to the production, utilization and improvement of nickel.

Aluminium ware has largely superseded cast iron hollow-war for domestic utensils for cooking, etc. Great efforts were made to induce the government to bring the industry under the Safeguarding of Industries Act with a view to a tariff for the exclusion of German imports. But the effort was unsuccessful. Birmingham makers have now introduced lighter ware of a cheaper character to meet the German competition, and these goods are selling freely. The makers, however, are very reluctant to adopt this light ware which they say injures the reputation of British goods. A recent reduction in cast iron hollow-ware has produced little effect in restoring the demand and aluminium obviously increases in popularity.

For industrial requirements duralumin largely made in Birmingham by a subsidiary firm of Vickers, Ltd., has met with an increasing demand especially for aircraft construction. It is understood that the all metal airship recently completed was manufactured of this new alloy, and the results will be watched with interest from the metallurgical point of view. There has been no dimunition in enthusiasm in the carrying out of research and the promotion of the technique of metal production.

So many electrical schemes are announced associated with large orders for locomotives that the Birmingham makers of non-ferrous metals look forward to increased activity in the coming year. This development will probably bring a scarcity of labor, brass casters and finishers being in inadequate supply and an early development is likely to be some scheme jointly promoted by the manufacturers and trade unions with a view to the encouragement of youths to enter the industry.—J. H.

Business Items—Verified

Griscom-Russell Company, New York, is now located at 285 Madison avenue, New York.

The **Fisher Brass Company,** Delaware, Ohio, contemplates the construction of a one-story factory, 50x150 ft.

The **Marsh Valve Company,** W. 4th street, Dunkirk, N. Y., is said to have preliminary plans for a one-story addition, but will not build at present.

Calveras Copper Company, Copperopolis, Cal., has tentative plans under consideration for a new refinery. It is also proposed to build a wire mill at this location.

Leiman Brothers, New York, have moved into their own four-story building located at 23 Walker street, N. Y. This will constitute the salesrooms and warehouse.

M. Hansen, a well known Chicago plater, has fitted up the building at 2711 Indiana avenue, Chicago, where he will do job plating in all metals, specializing on auto parts.

Brady Brass Company, Fourteenth and Henderson streets, Jersey City, N. J., is adding to its plant, two stories, 24x76 ft. This firm operates the following departments: bronze, aluminum foundry; brass machine shop.

National Casket Company, 3 Park square, Boston, Mass., is said to have plans under way for a new branch plant at Woodfin, vicinity of Asheville, N. C., to cost $250,000 with machinery. W. H. Donnell is manager.

Turner Brass Works, Sycamore, Ill., have arranged with the Prudential Insurance Company for a group policy protecting the lives of 85 men and women in the Turner plant for $1,000 each. The Turner company will pay all the premiums.

The **Diamond Power Specialty Corporation,** of Detroit, Michigan, announces the appointment of M. J. Miller, as sales engineer in charge of the Detroit district. Mr. Miller has had a long and successful career selling Diamond soot blowers.

Work will begin on a one-story foundry addition at the plant of the **Service Foundry Company,** Inc., 331 No. Mosley street, Wichita, Kan., 50x70 ft. This firm operates the following departments: brass, bronze, aluminum foundry; tool room, grinding room.

A. T. Anderson has fitted up a shop at 2443 W. North avenue, Chicago, Ill., for the manufacture of spun and cast specialties in brass, in addition to his regular gold and silver lines. The following departments are operated: casting shop, tool room, spinning, stamping, polishing, soldering, brazing, plating, lacquering.

The **J. F. Wagner's Sons Company,** 1147 South Seventh street, Louisville, Ky., recently organized with a capital of $75,000, will operate a plant for the manufacture of copper and galzanized iron cornices and kindred metal work. E. H. Wagner is president.

Wise Industries, Inc., 1033 Mt. Elliott avenue, Detroit, Mich., manufacturers of plated metal products, are erecting a one-story addition to its plant, to cost $25,000 with equipment. This firm operates the following departments: sherardizing, plating, stamping, polishing.

The **Co-Operative Foundry Company,** Rochester, N. Y., is planning to double the capacity of its porcelain enameling department. The Porcelain Enamel and Manufacturing Company, Baltimore, has been given the contract for this work. This firm operates a plating department.

The **Michigan Copper & Brass Company,** Detroit, Mich., manufacturer of brass, copper and aluminum sheets, has awarded the Austin Company, Cleveland and Detroit, a contract for an aluminum smelting building. This is the second recent addition for this growing Michigan company.

Miller & Towner Plating Works, have removed from 231 N. Wells street to the new building at 860 Weed street, Chicago, Ill., where they occupy the entire lower part. This concern does a general contract plating business and has a special department for enameling on buttons, badges and emblems.

The Dayton Bronze Bearing Company, Dayton, Ohio, has purchased the Air Friction Carburetor Company of that city, and has moved into its own plant, and will continue to manufacture carburetors. This firm operates the following departments: smelting and refining; brass, bronze, aluminum foundry; die casting.

The **Perfection Stove Company,** of Cleveland, Ohio, one of the largest stove manufacturing concerns in the United States, with a capitalization of $10,000,000, has just selected Atlanta as its district headquarters for the Southeast, according to Fred Newell, secretary of the industrial bureau of the Atlanta chamber of commerce. Offices and warehouse facilities have been secured by the company at 8 Courtland street.

Hugo Zeller, president of the **Zeller Manufacturing Company,** New York, has announced a change of address for the company's main office. The company has purchased the six-story office building at 20 East 49th street, New York City. Executive offices were formerly occupied by the company at 342 Madison avenue. The line of lacquers and lacquer enamels manufactured by this concern are known everywhere by the trade name Zellac.

The **Standard Brass and Iron Works,** 1820 St. Paul avenue, Milwaukee, Wis., has increased its capitalization from $25,000 to $100,000 for the purpose of enlarging its plant and production. The corporate style also has been changed to the Standard Brass Works, as the business is mainly the manufacture of brass fittings, hoops, valves, etc. Adolf H. Schott is vice-president and manager. This firm operates the following departments: brass, bronze, aluminum foundry; brass machine shop.

The **Asheville Supply & Foundry Company,** Eagle street, Asheville, N. C., has purchased two acres in the Biltmore district and contemplates the early erection of a new plant, consisting of a fabricating shop, 80 x 100 ft.; foundry for iron castings, 50 x 80 ft.; foundry for brass and bronze castings, 31 x 36 ft.; forge shop, 40x 51 ft.; machine shop, 50 x 100 ft.; welding shop 21 x 26 ft.; pipe and fitting shop 50 x 80 ft.; car repair shop, 30 x 50 ft.; storage buildings, etc., estimated to cost $200,000 with equipment. D. S. Hildebrand is president. This firm operates **a brass and bronze foundry.**

The sheet aluminum rolling mill of the **Sheet Aluminum Corporation** of Jackson, Mich., has commened operations producing a full line of aluminum sheets. Rolling mill equipment and other machinery is all specially designed. The Sheet Aluminum Corporation succeeds the **Northern Manufacturing Company,** which company was organized for plant construction purposes. The general sale offices of the company are located in the Ford Building, Detroit, with **W. J. Moore,** vice-president in charge of sales. Mr. Moore also is president of the **Allied Products Corporation** of Detroit, manufacturers of extruded aluminum mouldings, bars and shapes.

ABRASIVE SALES CONFERENCE

During the week of January 4, 1926, the Abrasive Company held its annual Sales Conference at their Philadelphia Plant. Plans for the current year were reviewed and unanimously approved by the sales representatives present. The conference sessions were presided over by Edward W. Dodge, Sales Manager.

The Officials of the company entertained the visiting field men at dinner on the evening of January 6, 1926.

BRONZE MEMORIAL TABLET

A tablet in memory of its late president, Mr. Henry R. Towne, has been erected by The Merchants' Association upon a pillar flanking the main entrance of the Association's offices on the ninth floor of the Woolworth Building, New York.

The memorial, which consists of a bronze tablet and inscription on marble, was authorized by the Board of Directors last January. It was designed and executed by the firm of J. and R. Lamb, New York, memorial art, to correspond with a similar tablet facing it on the left of the entrance which was erected several years ago in memory of the founder of The Merchants' Association, Mr. William F. King, who was its first president.

NEW POLYTECHNIC PRESIDENT

An event of interest to engineers and chemists generally took place on the evening of January 13, 1926, in the Opera House of the Academy of Music, Brooklyn, New York, when Dr. Parke Rexford Kolbe was installed as the new President of the Polytechnic Institute. Dr. Charles Alexander Richmond, president of Union College, gave the principal address of the evening. The presentation of the charter, seal and keys was made by Charles E. Potts, of the class of 1892, and now Chairman of the Board of Trustees of the Polytechnic. President Kolbe followed with his inaugural address. Other speakers were Dr. William H. Nichols, Chairman of the Board of the General Chemical Company and for many years Chairman of the Corporation of the Polytechnic; Dr. George S. Collins, senior member of the faculty, and Bancroft Gherardi, Chief Engineer of the American Telephone and Telegraph Company.

JENKINS COMPANY BANQUET

The fifth annual banquet of the staff of Jenkins Brothers, Ltd., Montreal, Canada was held on Dec. 10, 1925, in the Blue Room of the Windsor Hotel.

James Webb, Vice-President and Manager of the Canadian Company presided over the gathering. President Yardley of the parent company, New York, and a number of the Directors were present.

Moving pictures were shown under the title of Evolution of a Jenkins Brass Valve from the raw material to a finished product in all stages of manufacture. The entire plant in Bridgeport Conn., was shown in full operation. The pictures were shown the following day to all the employees, numbering 350, at the local plant.

AUTOMOBILE SHOW

At the Automobile Show, held at Grand Central Palace, New York, January 11-16, 1926, the exhibits consisted almost entirely of automobiles, and accessories and parts which can be purchased directly by the users. Metal manufactures were largely absent as were also metal finishes.

Among those interested in these lines were the following:

Egyptian Lacquer Manufacturing Company, New York. Automobile finish.

Light Manufacturing and Foundry Company, Pottstown, Pa. Metal castings, both sand cast and die cast, for automobile parts.

Federal Mogul Corporation, Detroit, Mich. Bearings, sand cast and die cast for automobiles.

MOTOR BOAT SHOW

The twenty-first annual Motor Boat Show was held in Grand Central Palace, New York, January 22-30, 1926. The exhibits were confined largely to power-driven boats of various types but a number of accessory and supply firms were also present.

Practically everything in the Show included metals of one sort or another as the marine industry is one of the large consumers of metal products. Among the exhibitors in the line of metal products as such, were the following: Columbian Bronze Corporation, Brooklyn, N. Y.; L. O. Koven & Brother, Inc., Jersey City, N. J.; National Carbon Company, Inc., New York, N. Y.; Edward Smith & Company, Long Island City, N. Y.; The Sperry Gyroscope Company, Brooklyn, N. Y.

INDUSTRIAL AND FINANCIAL NEWS

The **Earle Gear & Machine Company,** 4707-15 Stenton avenue, Philadelphia, Pa., announces the sale and transfer of all designs, patterns, patents and good will covering Earle centrifugal pumps to the Aldrich Pump Company, 1 Pine street, Allentown, Pa., which concern will continue the manufacture and marketing of same. This transfer will in no way conflict with the regular business of the Earle company, manufacturing as heretofore; Earle cut gears; Earle movable bridge operating machinery; "Lea-Simplex" cold metal saws; Earle special machinery.

The business of the **F. A. Coleman Company,** Cleveland, Ohio, including the equipment, patterns and patents, have been purchased by the **Foundry Equipment Company,** Cleveland.

The **Stuebing Truck Company** of Cincinnati, Ohio, and the **Cowan Truck Company** of Holyoke, Massachusetts, manufacturers of lift trucks and platforms under their respective names since 1912 have merged. The name of the new corporation is the **Stuebing-Cowan Company.** Headquarters will be in Cincinnati, Ohio.

The **Babcock & Wilcox Company,** New York, announces that it has purchased the Fuller-Lehigh Company and its subsidiaries, manufacturers of pulverized fuel and cement mill equipment; also that it has purchased the Bailey Meter Company, manufacturers of meters and recorders, combustion control equipment, pulverized fuel feeders and water cooled furnace walls. The Fuller-Lehigh Company and the Bailey Meter Company will be operated with the same organizations as heretofore, with the exception that Col. J. W. Fuller will become chairman of the board of the Fuller-Lehigh Company, E. G. Bailey will become president, and A. E. Douglass of Fuller-Lehigh Company will become vice-president in charge of sales.

METAL STOCK MARKET QUOTATIONS

	Par	Bid	Asked
Aluminum Company of America	...	$ 58	$ 62
American Hardware Corporation	$100	90½	92
Anaconda Copper	50	49½	50
Bristol Brass	25	7	9
International Nickel, com.	25	44½	45
International Nickel, pfd.	100	97	100
International Silver, com.	100	98	100
International Silver, pfd.	100	100	103
National Enameling & Stamping	100	37½	38½
National Lead Company, com.	100	170	171
National Lead Company, pfd.	100	116	117
New Jersey Zinz	100	207	210
Rome Brass & Copper	100	130	138
Scovill Manufacturing Company	...	230	235
Yale & Towne Mfg. Company, new	...	62	64

Corrected by J. K. Rice, Jr., Co., 120 Broadway, New York.

Review of the Wrought Metal Business

Written for The Metal Industry by J. J. WHITEHEAD, President, Whitehead Metal Products Company, New York

FEBRUARY 1, 1926.

It was noted that at the close of 1925 that a strong feeling of optimism was prevalent among the fabricators of metals and the belief was strong that the wave of prosperity sweeping over this industry was just getting under way, and would continue as far as could reasonably be anticipated into and through 1926. If January is to be considered any criterion by which this feeling of optimism may be judged, it can be said that the sentiment appears to be very well justified.

During the month buyers have placed orders in large volume and for sufficient tonnages to keep practically all of the mills going at full time. Prices for fabricated articles, such as rods, sheets, tubes and wire are on a level which are fairly satisfactory to both producers and consumers. As the month closed there was a reduction in the price of some of these articles, due to a reduction in the price of zinc. This did not affect sheet copper, however, for which there is still a very heavy demand. The building trade, together with the manufacturers of washing machines, and electric refrigeration cabinets, still hold their place in the sun as the three important factors in the consumption of sheet copper. All of these industries are going forward at a record-breaking pace and there seems to be no sign of a slump in the demand from any of them. As a matter of fact, the electrical refrigeration industry seems to be only in its infancy. New companies are being formed practically every month with huge amounts of capital involved for the manufacture of ice cream cabinets and home refrigerators and as all of them are using sheet copper and seamless copper tube it looks as though the mills will be able to depend upon this line of trade for the consumption of a large portion of their output for some time to come, and in ever increasing volume.

Inasmuch as practically all of these ice cream cabinets and refrigerators require white metal trim, the manufacturers of nickel copper alloy have been kept busy supplying this demand, which has been responsible for a large part of the activities in the mills producing these alloys. Monel metal has the call in practically all of this work, as most of the ice cream cabinets are being finished with Monel metal tops and trim. The manufacturers of this alloy are increasing their plants so as to double the output of high finish Monel sheet and strip in order to make it possible to keep deliveries up to the level of the requirements.

The strength of the demand for white metal throughout the hotel field is indicated by the fact that practically all of the numerous hotels which have been constructed in Florida and are opening this year, are equipped throughout their kitchens with Monel metal trim, and pure nickel cooking utensils. Along these lines also it is noted that many manufacturers of canned fruits and vegetables have adopted pure nickel jacket kettles for their equipment for cooking their product and installations have been made recently in some of the largest plants in the country.

From all indications, it is expected that 1926 will be a banner year for these industries and so strong is the feeling of assurance in this regard, that the principal manufacturers are adding new buildings and new equipment representing the investment of large sums of money to their plants in order to keep up with the demand.

Metal Market Review

Written for The Metal Industry by R. J. HOUSTON, of D. Houston & Company, Inc., Metal Brokers, New York

FEBRUARY 1, 1926.

COPPER

There was a relatively easy market for copper lately, and January prices moved within the narrow range of about 14@14⅛ cents delivered to eastern points. Buying was in moderate volume, but new demand was not sufficiently aggressive to materially affect market tendencies. It is natural for business to be seasonably dull at the beginning of the year, but the general outlook seems to be favorable for the indefinite continuance of heavy consumption.

We are starting 1926 at about a cent per pound lower than early in 1925. The statistical position is much stronger now, however, and warrants a firmer market. The general state of industry is favorable, and the outlook is for an exceedingly heavy demand. The obvious danger is that production may be forced ahead of consumers' requirements.

TIN

Recent developments in the tin market are indicative of the risks and uncertainties inherent in the present situation. The year began with world visible supplies of 18,024 tons, or about 7,000 tons less than twelve months previous. If the future course and trend of domestic demand equals or exceeds that of 1925, it will prove a powerful market support. Prices, however, have discounted the strong statistical position of tin, but with limited supplies and great industrial activity, it is expected that the market will be subject to periods of tense strain during the next few months.

At present Straits tin is quoted at 60.40c@60.75c, and compares with 63.50c at beginning of year. The average price of Straits tin at New York in 1925 was 57.90c, against 50.20c in 1924 and 42.71c in 1923. The average price for 1921 was 30 cents. But American deliveries in 1921 were only about one-third the total tonnage for 1925.

ZINC

A substantial decline has occurred since the first of the year in zinc prices. The market setback appears to be due in good measure to the inaction of buyers. With continued excellent consumption, and a statistical position regarded as sound, a more active buying movement should develop in the next few weeks. The accumulation of new business in recent months absorbed output at a rapid rate and cut down stocks at smelters at beginning of 1926 to less than half what they were twelve months ago. Exports last year were also an important feature. The total American production in 1925 reached 594,928 tons, against 535,202 tons in 1924. Deliveries last year were 602,841 tons, compared with 551,216 tons for previous year. Stocks at end of 1925 amounted to 9,295 tons, against 21,208 tons on December 31, 1924. Prime Western Zinc quotes 8 cents East St. Louis basis and 8.35c at New York.

LEAD

No considerable change has taken place in the domestic lead market lately. Consuming demand continues to furnish a steady outlet for supplies, and the New York position quotes 9.25c, with East St. Louis on the basis of 9.10c@9.15c. The foreign market has been subjected to frequent fluctuations, but being under speculative influences this feature is prominent as a background for important movements.

Large supplies were recently released from Australia and shipped to the United Kingdom. These shipments are reported at about 25,000 tons in addition to arrivals from other sources. The extra supplies abroad was somewhat of a damper on the market. Foreign prices reacted to some extent, and this caused some hesitation here. Domestic consumption holds up well with a good demand for nearby future shipments. United States production of lead in 1925 amounted to 572,738 tons, as compared with 523,353 tons in 1924.

ANTIMONY

Market for Antimony has relaxed lately. The high prices caused hesitation among buyers and concessions resulted. A few weeks ago activity of demand and firmness of sellers sent the market up to 25 cents duty paid. Requirements were largely covered on recent movements for the time being. Dullness followed as a matter of course with values abnormally high owing to unsettled conditions in China. There is a revival of interest noted at present which may eventuate in orders on the lower basis of around 18¾ c.i.f. New York for forward shipment. The spot price quotes 22c duty paid for Chinese 99 per cent regulus.

ALUMINUM

The Aluminum market is steady at 28c for 99 per cent plus and 27c for 98-99 per cent metal. Conditions have been quiet and new requirements are held in abeyance. There has been some buying for future deliveries, but the recent action by the leading

producer in reducing prices appears to have operated against large volume business. There is some talk of a possible reduction in the duty on aluminum, but this is problematic and a matter of speculation. Production and consumption in 1925 were on a record scale. New demand in current year is expected to show heavy requirements.

QUICKSILVER

The position of the market is not as firm as it was a few weeks ago. The December price touched $92 per flask, and compares with the current quotation of $88. Reduced output of Spanish supplies and prospects of increased demand tend to keep the market steady on present basis.

PLATINUM

Refined platinum quotes $114.50 per ounce and undertone of market is not specially strong. The recent arrival in London of 50,063 ounces from Russia is reported. This large shipment is expected to be supplemented by further important quantities from the same source.

SILVER

Conditions in the silver market have been comparatively quiet for the past several weeks. China has both bought and sold to a limited extent. India was a recent buyer on a moderate scale. Orient demand, however, is not sufficiently important to exert much influence on the market trend. General conditions are quiet, and the future course of the market will probably be determined by the attitude of sellers. Prices during the last half of January reacted three-quarters of a cent an ounce and closed at 67 cents. According to Handy & Harmon the arts and industries in the United States used more silver during 1925 than ever before. The consumption, according to their estimate, was 31,000,000 ounces, or 11 per cent more than 1924, and 6 per cent more than 1923, which was the best year heretofore. Imports of silver by India during 1925 are estimated at one hundred and six million ounces, an amount about equal to last year's figure. Chinese purchases last year are computed at about fifty-nine million ounces from United States, London and Canada. The authority above quoted estimates the total world production of silver in 1925 at 238,000,000 ounces, and total world consumption for last year at 245,000,000 ounces.

OLD METALS

There has been a fair movement in scrap metals, but the easier tendency for new metals has reduced both values and activity in the various grades of old material specially affected by prices in the primary markets. Consumption of old stock, however, continues heavy. Supplies of certain grades do not appear to be excessive, and current quotations are reluctantly reduced when concessions are forced upon holders. A good outlet was reported for scrap copper and brass. Lead scraps were also in good demand, with offerings light. Signs of further weakness in new copper had a depressing effect on the market for scrap and alloys. Prices at close of month, based on what dealers' were ready to pay, were quoted at 11½c for heavy copper, 9½c for light copper scrap, 7c for heavy brass, 9¼c for new brass clippings, 6c for light brass, 7¾c@8c for heavy lead, 4½c@4¾c for old zinc, and old aluminum castings 19c.

WATERBURY AVERAGE

Lake Copper—Average for 1925, 14.427—January, 1926, 14.25c.

Brass Mill Zinc—Average for 1925, 8.263—January, 1926, 9.00c.

Daily Metal Prices for the Month of January, 1926

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	1*	4	5	6	7	8	11	12	13	14	15	18
Copper (f. o. b. Ref.) c/lb. Duty Free...												
Lake (Delivered)	......	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.125
Electrolytic	......	13.95	13.95	13.95	13.95	13.95	14.00	14.05	14.05	14.00	13.95	13.90
Casting	......	13.375	13.375	13.375	13.375	13.375	13.40	13.45	13.45	13.45	13.40	13.30
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb.												
Prime Western	......	8.75	8.75	8.75	8.75	8.75	8.70	8.70	8.70	8.65	8.60	8.45
Brass Special	......	8.90	8.90	8.90	8.875	8.85	8.85	8.85	8.80	8.80	8.75	8.65
Tin (f. o. b., N. Y.) c/lb. Duty Free...												
Straits	......	63.50	63.375	63.25	63.00	62.75	62.25	62.75	63.125	63.00	63.00	62.00
Pig 99%	......	62.625	62.50	62.25	62.25	61.75	61.25	61.75	62.125	61.75	62.00	61.25
Lead (f. o. b. St. L.) c/lb. Duty 2⅛c/lb.	......	9.20	9.20	9.20	9.20	9.20	9.20	9.20	9.20	9.20	9.15	9.15
Aluminum c/lb. Duty 5c/lb.	......	28	28	28	28	28	28	28	28	28	28	28
Nickel c/lb. Duty 3c/lb												
Ingot	......	34	34	35	35	35	35	35	35	35	35	35
Shot	......	35	35	36	36	36	36	36	36	36	36	36
Electrolytic	......	38	38	39	39	39	39	39	39	39	39	39
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	......	25.00	25.00	24.75	24.75	24.50	24.25	24.25	24	24	24	23
Silver c/oz. Troy Duty Free	......	68.625	68.50	68.50	68.625	68.50	68.375	68.375	68.375	68.125	67.875	67.50
Platinum $/oz. Troy Duty Free	......	116	116	116	116	116	116	116	116	116	116	116

	19	20	21	22	25	26	27	28	29	High	Low	Aver.
Copper (f. o. b. Ref.) c/lb. Duty Free...												
Lake (Delivered)	14.125	14.125	14.125	14.125	14.125	14.125	14.125	14.125	14.125	14.25	14.125	14.188
Electrolytic	13.90	13.95	13.95	13.90	13.90	13.90	13.90	13.85	13.85	14.05	13.85	13.940
Casting	13.30	13.35	13.35	13.35	13.35	13.35	13.25	13.25	13.25	13.45	13.25	13.360
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb.												
Prime Western	8.30	8.40	8.40	8.30	8.10	8.10	8.05	8.00	8.00	8.75	8.00	8.46
Brass Special	8.55	8.55	8.50	8.40	8.25	8.25	8.20	8.15	8.15	8.90	8.15	8.606
Tin (f. o. b., N. Y.) c/lb. Duty Free...												
Straits	61.75	61.75	62	62.25	61.75	61.50	61.125	61	60.75	63.50	60.75	62.275
Pig 99%	61.00	61.125	61.25	61.50	61.00	60.75	60.375	60.125	60.00	62.625	60.00	61.431
Lead (f. o. b. St. L.) c/lb. Duty 2⅛c/lb.	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.20	9.15	9.173
Aluminum c/lb. Duty 5c/lb.	28	28	28	28	28	28	28	28	28	28	28	28
Nickel c/lb. Duty 3c/lb												
Ingot	35	35	35	35	35	35	35	35	35	35	34	34.90
Shot	36	36	36	36	36	36	36	36	36	36	35	35.90
Electrolytic	39	39	39	39	39	39	39	39	39	39	38	38.90
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	23	22.50	22.50	22.50	22	22	22	22	22	25.00	22	23.400
Silver c/oz. Troy Duty Free	67.75	67.375	67	67.125	67.25	67.25	67	67.125	67	68.625	67	67.813
Platinum $/oz. Troy Duty Free	116	116	116	116	114.5	114.5	114.5	114.5	114.5	116	114.5	115.625

* Holiday.

Metal Prices, February 5, 1926

NEW METALS

Copper: Lake, 14.50. Electrolytic, 14.30. Casting, 13.75.
Zinc: Prime Western, 8.10. Brass Special, 8.20.
Tin: Straits, 63.25. Pig, 99%, 62.25.
Lead: 9.15. **Aluminum**, 28.00. **Antimony**, 22.00.

Nickel: Ingot, 35. Shot, 36. Elec. 39. Pellets cobalt free, 40.
Quicksilver, flask, 75 lbs., $88.00. **Bismuth**, $3.30 to $3.35.
Cadmium, 60. **Cobalt**, 97%, $2.60. **Silver**, oz., Troy, 66.875.
Gold, oz., Troy, $20.67. **Platinum**, oz., Troy, $114.50.

INGOT METALS AND ALLOYS

Brass Ingots, Yellow	10¾to11¾
Brass Ingots, Red	11¾to12¾
Bronze Ingots	11¾to12¾
Casting Aluminum Alloys	21 to24
Manganese Bronze Castings	23 to41
Manganese Bronze Ingots	13 to17
Manganese Bronze Forging	34 to42
Manganese Copper, 30%	28 to45
Monel Metal Shot	32
Monel Metal Blocks	32
Parsons Manganese Bronze Ingots	18¼to19¾
Phosphor Bronze	24 to30
Phosphor Copper, guaranteed 15%	18⅞to22½
Phosphor Copper, guaranteed 10%	18 to21½
Phosphor Tin, guaranteed 5%	70 to80
Phosphor Tin, no guarantee	65 to75
Silicon Copper, 10% ......according to quantity	28 to35

OLD METALS

Buying Prices		Selling Prices
12½to12½	Heavy Cut Copper	13¼to13¾
12 to12¼	Copper Wire	13 to13½
10¼to10¾	Light Copper	11½to12
9¼to 9½	Heavy Machine Comp.	10¾to11¼
8 to 8¼	Heavy Brass	9¼to 9½
7 to 7¼	Light Brass	8 to 8½
8 to 8½	No. 1 Yellow Brass Turnings	10 to10½
8¾to 9	No. 1 Comp. Turnings	10½to11
8½to 8¾	Heavy Lead	9¼to 9½
5 to 5¼	Zinc Scrap	6 to 6½
12 to13	Scrap Aluminum Turnings	15 to17
19 to20	Scrap Aluminum, cast alloyed	21 to22
23 to24	Scrap Aluminum, sheet (new)	25 to26½
38 to40	No. 1 Pewter	42 to44
12	Old Nickel anodes	14
18	Old Nickel	20

Wrought Metals and Alloys

COPPER SHEET

Mill shipments (hot rolled)....... 21¾c. to 22¾c. net base
From stock .... 22¾c. to 23¾c. net base

BARE COPPER WIRE

16⅛c. to 16¾c. net base, in carload lots.

COPPER SEAMLESS TUBING

24½c. to 25½c. net base.

SOLDERING COPPERS

300 lbs. and over in one order .... 21¼c. net base
100 lbs. to 200 lbs. in one order............ 21¾c. net base

ZINC SHEET

Duty, sheet, 15%	Cents per lb.
Carload lots, standard sizes and gauges, at mill, less 8 per cent discount	**12.00 net base**
Casks, jobbers' price	**13.25 net base**
Open Casks, jobbers' price	13.75 to **14.00 net base**

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga., base price	40c.
Aluminum coils, 24 ga., base price	36.70c.
Foreign	40c.

ROLLED NICKEL SHEET AND ROD

Net Base Prices

Cold Drawn Rods	58c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	50c.	Hot Rolled Sheet	52c.

BLOCK TIN SHEET

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c or over Pig Tin; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 17c. over; less than 25 lbs., 25c. over.

SILVER SHEET

Rolled sterling silver, 67½ to 69½c.

BRASS MATERIAL—MILL SHIPMENTS

In effect February 4, 1926
To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.19⅛	$0.20⅝	$0.22⅝
Wire	.19⅝	.21⅛	.23⅛
Rod	.16⅞	.21⅜	.23⅜
Brazed tubing	.27⅛	......	.32⅜
Open seam tubing	.27⅛	......	.32⅜
Angles and channels	.30⅛	......	.35⅜

For less than 5,000 lbs. add 1c. per lb. to above prices.

BRASS SEAMLESS TUBING

23¾c. to 24¾c. net base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	21⅛c. net base
Muntz or Yellow Metal Sheathing (14"x48")	19⅛c. net base
Muntz or Yellow Rectangular sheet other Sheathing	20⅛c. net base
Muntz or Yellow Metal Rod	17⅛c. net base

Above are for 100 lbs. or more in one order.

NICKEL SILVER (NICKELENE)

Net Base Prices

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	27c.	10% Quality	30c.
15% "	28½c.	15% "	33¾c.
18% "	29¾c.	18% "	37c.

MONEL METAL SHEET AND ROD

Hot Rolled Rods (base)	35	Hot Rolled Sheets (base)	42
Cold Drawn Rods (base)	43	Cold Rolled Sheets (base)	50

BRITANNIA METAL SHEET

No. 1 Britannia—18" wide or less, No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. to 500 lbs., 10c. over; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 20c. over; less than 25 lbs., 25c. over. Prices f. o. b. mill.

Supply Prices, February 5, 1926

ANODES

Copper: Cast	21¾c. per lb.	
Rolled	20⅝c. per lb.	
Electrolytic	19 c. per lb.	
Brass: Cast	20¾c. per lb.	
Rolled	20⅝c. per lb.	
Zinc: Cast	14¾c. per lb.	

Nickel: 90-92%	45c. per lb.
95-97%	47c. per lb.
99% plus	49c. per lb.

Silver: Rolled silver anodes .999 fine are quoted from 70¼c. to 72¼c. per Troy ounce, depending upon quantity purchased.

FELT POLISHING WHEELS WHITE SPANISH

Diameter	Thickness	Under 100 lbs.	100 to 200 lbs.	Over 200 lbs.
10-12-14 & 16"	1" to 3"	$3.00/lb.	$2.75/lb.	$2.65/lb.
6-8 & over 16	1 to 3	3.10	2.85	2.75
6 to 24	Under ½	4.25	4.00	3.90
6 to 24	½ to 1	4.00	3.75	3.65
6 to 24	Over 3	3.40	3.15	3.05
4 up to 6	¼ to 3	4.85	4.85	4.85
4 up to 6	Over 3	5.25	5.25	5.25
Under 4	¼ to 3	5.45	5.45	5.45
Under 4	Over 3	5.85	5.85	5.85

Grey Mexican Wheel deduct 10c per lb. from White Spanish prices.

COTTON BUFFS

Full Disc Open buffs, per 100 sections.

12" 20 ply 64/68 Unbleached	$33.70–35.20
14" 20 ply 64/68 Unbleached	43.40–43.80
12" 20 ply 80/92 Unbleached	35.40
14" 20 ply 80/92 Unbleached	48.00
12" 20 ply 84/92 Unbleached	41.90–45.25
14" 20 ply 84/92 Unbleached	56.80–60.55
12" 20 ply 80/84 Unbleached	40.15–41.35
14" 20 ply 80/84 Unbleached	54.40–55.70

Sewed Pieced Buffs, per lb., bleached .70c.

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.12–.16
Acid—Boric (Boracic) Crystals	lb.	.12
Hydrochloric (Muriatic) Tech., 20°, Carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb.	.06
Hydrofluoric, 30%, bbls	lb.	.08
Nitric, 36 deg., Carboys	lb.	.06
Nitric, 42 deg., carboys	lb.	.07
Sulphuric, 66 deg., Carboys	lb.	.02
Alcohol—Butyl	lb.	.18½–.23
Denatured in bbls	gal.	.60–.62
Alum—Lump Barrels	lb.	.03¾
Powdered, Barrels	lb.	.042
Aluminum sulphate, commercial tech	lb.	.02⅜
Aluminum chloride solution in carboys	lb.	.06½
Ammonium—Sulphate, tech, bbls	lb.	.03¾
Sulphocyanide	lb.	.65
Arsenic, white, kegs	lb.	.08
Asphaltum	lb.	.35
Benzol, pure	gal.	.60
Borax Crystals (Sodium Biborate), bbls	lb.	.05½
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.06
Chrome Green, bbls	lb.	.31
Copper— Acetate (Verdegris)	lb.	.37
Carbonate, bbls	lb.	.17
Cyanide (100 lb. kegs)	lb.	.50
Sulphate, bbls	lb.	.05
Cream of Tartar Crystals (Potassium bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05–.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$75.00
Fusel Oil	gal.	$4.45
Gold Chloride	oz.	$14.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.59–.61
Iron, Sulphate (Copperas), bbl	lb.	.01½
Lead Acetate (Sugar of Lead)	lb.	.13
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.15
Nickel—Carbonate dry, bbls	lb.	.29
Chloride, bbls.	lb.	.21
Salts, single 300 lb. bbls	lb.	.10½
Salts, double 425 lb. bbls	lb.	.10
Paraffin	lb.	.05–.06
Phosphorus—Duty free, according to quantity		.35–.40
Potash, Caustic Electrolytic 88-92% fused, drums	lb.	.093
Potassium Bichromate, casks (crystals)	lb.	.08½
Carbonate, 88-92%, casks	lb.	.06¼
Cyanide, 165 lb. cases, 94-96%	lb.	.57½
Pumice, ground, bbls	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.08
Silver Chloride, dry	oz.	.86
Cyanide (Fluctuating Price)	oz.	.66
Nitrate, 100 ounce lots	oz.	.48
Soda Ash, 58%, bbls	lb.	.02½
Sodium—Cyanide, 96 to 98%, 100 lbs	lb.	.20
Hyposulphite, kegs	lb.	.04
Nitrate, tech., bbls	lb.	.04¾
Phosphate, tech., bbls	lb.	.03¾
Silicate (Water Glass), bbls	lb.	.02
Sulpho Cyanide	lb.	.45
Sulphur (Brimstone), bbls	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.43½
Tripoli, Powdered	lb.	.03
Wax—Bees, white ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½–.06
Zinc, Carbonate, bbls	lb.	.11
Chloride, casks	lb.	.07⅜
Cyanide (100 lb. kegs)	lb.	.41
Sulphate, bbls.	lb.	.03⅛